

PAPER TO

“2016 PNG Update : “Sustaining Development (in PNG) beyond the Resources Boom”

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Paper presented on topic in Session 1C titled **“Sustainability and Development”** as one of five ESG presentations.

The History of Sustainable Development in Papua New Guinea: Changes, challenges and lessons learned from 1975 to 2016 and beyond.

Paper is accompanied by Power Point presentation 2016 under **“Sustainability and Development”** section as one of five ESG presentations.

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Abstract

This paper describes the path PNG has traveled on the way to our new future, the aspirations of a modified **Vision 2050** and our new government strategy for responsible sustainable development in PNG, known as “StaRS”. It discusses the evolution or history of sustainable development in Papua New Guinea; and the lessons we can learn from that history. Our understanding of the terms sustainable development and sustainability have changed much since the first World Conservation Strategy of 1980 and “*Our Common Future*” in 1987 and Rio in 1992. History educates us to rethink, reevaluate and redo.

At independence, PNG's founding fathers had the foresight to enshrine environmental and sustainability concerns into the national constitution. The five National Goals and Directive Principles of PNG's constitution reflect a commitment to sustainable development and PNG ways.

Following the 1992 World Summit on Environment and Development (at Rio) PNG developed its own National Sustainable Development Strategy in two documents called *Stretim Nau Bilong Tumora* and *Yumi Wankain*. It was PNG's ‘Agenda 21’ and a reaffirmation of our national constitution. It was our commitment to ecologically sustainable development (ESD), termed by Charles Abel as “responsible sustainable development”.

Over the next decade much of this seemed to be largely forgotten. However key publications included the PNG Human Development Report, the PNG Population Policy and our PNG Millennium Development Goals.

Vision 2050 was published in 2009 setting out the road map for what was termed a visionary development strategy to guide our sustainable development ‘**We will be a Smart, Wise, Fair, Healthy and Happy Society by 2050.**’ It was an aspirational statement and a vision for our future. But it too needs updating and suggested improvements are given.

StaRS provides a totally new paradigm for development in PNG. It does not replace our development plans but elevates within them the principles of responsible sustainable development and strategic planning. The

shift is to a new road map built on strong sustainable development principles, sustainable livelihoods and green growth and the change to a green economy in Papua New Guinea.

In studying the history of sustainable development, we learn to understand that sustainable development and sustainability mean very different things to different people across different disciplines, different backgrounds and totally different World Views. From the lessons of history, this paper stresses the need to change both our mindset and world views and our current economic system, reject denial and to transform PNG into a green economy.

Hence we can learn from our history and more confidentially achieve our aspirations as stated in a modified Vision 2050, and to implement the Sustainable Development Goals in PNG, to move beyond our failure to achieve any of the Millennium Development Goals. This is the 'Development Revolution' that our National Strategy for Responsible Sustainable Development requires and we can do it the "PNG way".

What we need is an economic system based on strong sustainability, green economic principles and those of ecological economics, green accounting, strategic planning and both political economy and political ecology. One where we put a full value on environmental variables, social justice and ecological justice. Externalities are all internalised. Addiction to growth is 'no-more'. Discount rates are realistic. Economic instruments support government regulations and community attitudes. We aim for the integration of ecological, social, environmental, institutional and personal sustainability. We reject denial and easy solutions. We aim toward peace and a non-violent social and participatory democracy. We reject wealth and "too-muchness" as an objective but aim for "enoughness". We aim for an ecological footprint that is sustainable.

And we can do it the PNG way. "StaRS" is our strategy and a revised Vision 2050 is our aspirational statement.

As an addendum a small summary of the Bachelor of Sustainable Development Programme at UPNG is given.

Keywords/terms:

environmental science, sustainable development, strong sustainability, green growth, green development, Papua New Guinea, Sustainable Development Goals, environmental or ecological sustainability, StaRS.

PNG's Sustainable Development Strategy

In March 2014 the Minister for National Planning and Monitoring Mr Charles Abel presented a new development agenda for PNG, He called it a 'development revolution' for PNG. He proposed the new National Strategy for Responsible Sustainable Development. In fact it is a resurrection of an earlier PNG National Sustainable Development Strategy that was accepted by NEC back in 1994 but long since forgotten. Moreover this is a greatly improved strategy with firm PNG Government support (Abel, 2014a,b and that of the Department of Planning and Monitoring,(2014a). By this, the PNG Government has committed itself to move from the old paradigm of brown development based on Capitalism to a new green development strategy and a completely new paradigm, based on sustainable development principles. See Box 1 which summarises some of Minister Charles Abel's points given in a Power Point presentation he gave in March 2014:.

Box 1.

PNG leading the Way – A Development Revolution. The new Paradigm – the new way.

From Hon Charles Abel, Minister for National Planning and Monitoring, in Alotau, power point presentation, March 2014.

on the **National Strategy for Responsible Sustainable Development for Papua New Guinea**

PNG leading the Way – A Development Revolution. How can we bring a smarter approach to development that clearly responds to our Constitutional Guiding Goals and Directive Principles?

These values are at the heart of our Constitution as captured in our National Goals and Directive Principles:

- Integral Human Development
- Equality and Participation by all
- Enhancement of National Sovereignty and Self-Reliance
- Responsible Management and Use of our Natural Resources. For Environment and Sustainable Assets
- PNG Ways

Why change?

- copycat
- corruption
- poverty
- conflict and violence
- environmental destruction
- inequality
- overpopulation

What is needed?

- Good leadership and good governance
- shared responsibility
- peace and harmony
- environmental protection
- equality
- stable population

We can be leaders not followers... we are in an unique position to choose a future that is responsible and sustainable in a changing world – world leaders in responsible development.

The concept and acceptability of the paradigm of sustainable development is one that has evolved over the last 40 years

or so. See the two papers by Mowbray (2014a, b); both are up on the PNG Greens Party website (www.pnggreensparty.org.pg; last accessed on November 2016).

The concept and meaning of sustainable development has changed much. But there is much that we can learn as we see how PNG embraced the concept, accepted it, ignored it and then embraced it again. Sustainable development in Papua New Guinea has also changed; and the lessons we can learn from our history of sustainable development in PNG can be most useful. Our understanding of the terms sustainable development and sustainability have changed much since the first World Conservation Strategy of 1980 and “*Our Common Future*” in 1987 and Rio in 1992. History educates us to rethink, reevaluate and redo.

This history of sustainable development both as a concept and as a development strategy is given in Mowbray (2014; 2016 (PNG Greens website)), but summarised in Box 2 below

Box 2

Major Events in History of Sustainable Development

1962 Publication in USA of book by Rachel Carson called “*Silent Spring*”. Brought to attention the ‘toxicification’ of our environment by pesticides. Spurred the beginning internationally of environment movements.

1968 United Nations General Assembly (UNGA). UN injected the environmental dimension together with social and economic dimensions in the development debate / process. Ecologically sustainable development or ESG was born!! From now it was no more “socio-economic development”, but an integrated “economic, social and ecologically (later sustainable) development.

1972 Publication of famous book “*Limits to Growth*” by the Meadows –(with subsequent publication in 1992 of “*Beyond the Limits*”. These books recognised limits or boundaries to environmental change; the 1991 book focuses on how to achieve a transition to a sustainable global future.

1972 Stockholm Declaration created United Nations Environment Programme (UNEP).

1980 IUCN, UNEP and WWF developed the First World Conservation Strategy republished in 1991 as the document “*Caring for the Earth*”, the Second World Conservation Strategy which adopted sustainable development as its central concept. Here reference is to the greening of development theory with the terms sustainability and sustainable development inferred. Also it recognised the important role of early conservationists over the previous 100 years. Basically this is where the term “sustainable development” was born.

1987 Gro Harlem Brundtland published the report by the World Commission on Environment and Development, known as “*Our Common Future*”; this report legitimised and popularised the terms ‘sustainability and sustainable development’.

1990 First Publication by UNDP of the annual “Human Development Reports”. Published yearly from 1990 to 2015.

1992 The United Nations Conference on Environment and Development, the Rio Conference. Here the term sustainable development was accepted into development discourse and further popularised. Outputs included Agenda 21, The Rio Declaration and the Conventions on both Climate Change and Biodiversity. Here the term “sustainable development” was “institutionalised.

1992 Release by SPREP of the *Pacific Way* – to the Rio Conference.

1995 Publication by Mathias Wackernagel and William Rees of the concept of “The Ecological Footprint”

2000. Initiation by UN at Millennium Summit of the eight Millennium Development Goals 2000-2015.

2000. Acceptance of the best international statement on “sustainability”, “*The Earth Charter*” orchestrated and presented to the international community by Maurice Strong (Canada) and Mikhail Gorbachev (Russia). This statement incorporated (1) respect and care for the community of life”, (2) ecological integrity, (3) social and economic justice, (4) democracy, non-violence and peace, and (5) a statement on the way forward.

2002. The Rio + 10 Conference on Sustainable Development in Johannesburg with aim to implement a sustainable development framework. Regarded as not a successful conference.

2005 Initiation of The *Pacific Plan* aimed at strengthening regional integration and co- operation.

2005 – 2015. Publications by various authors Chiras, Miller, Daley, Costanza, Washington (see Appendix Box 9) of the need to distinguish between the much differing concepts of strong sustainability (as advocated by environmental scientists and ecological economists) and that of weak sustainability(or “business as usual”) as advocated by economists. Over this period the concept of sustainable development evolved and changed greatly. The term **sustainability** became used instead by many environmental scientists who contended that sustainable development was an oxymoron. The terms sustainable development and sustainability became “sexy” and every one started using them. But what people meant by sustainability depended much on their world view. See the definitions of sustainability in Appendix Box 8.

2012 The Rio + 20 Conference on Sustainable Development with a shift in emphasis toward green growth and green development; and agreement to initiate the process to achieve sustainable development goals. Criticism was made that Rio +20 in Rio de Janeiro in 2012 was too “pro-growth” and unashamedly anthropocentric. Many green and ecological economists and environmental scientists say it is inappropriate for the green economy to be such. We need the new paradigm of green not brown development with an eventual goal of a steady state economic, social and ecological systems, due to our increasing ecological footprint which is obviously unsustainable..

2015 Agreement at UN of the 17 Sustainable Development Goals to supersede the MDGs , from 2016-2030.

2015 Paris Conference on Climate Change. Here a recognition of a limit of 1.5°C to avoid ecological collapse, but most countries only accepted a 2°C rise, and most refused to commit themselves to this target; Such causes much dilemma and despair in the Pacific and to other low-lying nations

PNG is committed to both sustainable development and action on climate change

Evolution of PNG's Sustainable Development Strategy

This section deals with the evolution or history of the National Strategy for Sustainable Development in PNG. This paper is a modification and update of that by Mowbray (2014 paper 2 below) which was part of a trilogy of papers presented to Research Science and Technology Conference in November 2014 on “Promoting Responsible Sustainable Development through Science and Technology, the PNG Way. These three papers were titled

1. What is Sustainable Development? What is its History and Meaning?
2. What is the History of Sustainable Development in PNG?
3. From Rio to Rai to Now to ESD to *Ples*: The New Paradigm.

All were accepted for publication and meant to be published in Volume 2 , the Environment Pillar. Of the Conference4 proceedings. See Mowbray (2014). Unfortunately the second one on the history of sustainable development leading up to PNG's National Strategy for Responsible Sustainable Development was accidentally omitted from the final publication despite the author being one of the editors!. The first two papers appear however from 2015 in a slightly modified form on the PNG Greens Party website at www.pnggreensparty.pg.com (Mowbray 2016).

This history of sustainable develop in PNG is summarised in Box 3 below and then elaborated on following the box.

Box 3

History of Sustainable Development in Papua New Guinea

1975 At Independence, adoption of the new Papua New Guinea Constitution that lists five national goals and directive principles. See Box 3. These directive goals commit PNG to a sustainable development strategy, even before the terms ‘sustainable development’ and ‘sustainability’ entered the international discourse / conversations.

1977 Formation of the Office of Environment and Conservation (then Department of Environment and Conservation = DEC; now the Conservation and Environmental Protection Authority (CEPA).

1982 UPNG establishes a Programme of Environmental Science.

1991 Launching at 19th Waigani Seminar (on Population, Family Health and Development) of PNG’s First Population Policy by Prime Minister Rt Honourable Rabbie Namalieu (and in memory of the driver of the policy, his wife Ms Margaret Nakikus).

1991 Still only one staff coordinating the Environmental Sciences programme.

1992. PNG Preparation for Rio Earth Summit, and attendance and signing up of all instruments (see Box 5).

1993 UPNG holds 20th Waigani Seminar (organised by Environmental Science programme) on the topic: *From Rio to Rai: Environment and Development in PNG*. This was PNG’s response to its obligations to having signed all instrument at the Rio Earth Conference / UNCED. Subsequent publication of booklet “*Stretim Nau Bilong Tumora*”.

1994 Publication of *Yumi Wankain*; and PNG Government signing in a preliminary National Strategy for Sustainable Development.

1996 Publication by UPNG of the six book series *From Rio to Rai: Environment and Development in PNG*. (see Appendix Box 9)..

1997 Publication of *Kumil 2020* which advocated a shift from the modernisation development paradigm to a sustainable one.

2005 Geography at UPNG merges with Environmental Science to form the Discipline of Environmental Science and Geography (ESG) within the School of Natural and physical Sciences.

2007- 2012. The National Sustainable Development Strategy all but forgotten!!

2009. Adoption of Vision 2050. 2012 Resurrection of the Department of National Planning and Monitoring.

2012. The PNG Government of Rt Hon Peter O’Neil signs the *Alotau Accord*. Through the leadership of Hon Charles Abel, Minister for National Planning, PNG Governments commits itself to the new paradigm of green instead of brown development, to a strategy of ecologically sustainable development (ESD) termed by Charles Abel as “responsible sustainable development”. Introduction and support to StaRS by Rt Honourable Peter O’Neill.

2014 Adoption of the first National Sustainable Development Strategy, known as “The Strategy”

2014 Publication of the National Population Policy 2015-2024 – promoting a viable population and environment within the paradigm of responsible sustainable development.

2015 Adoption of the revised National Sustainable Development Strategy, known as “StaRS”. Both “The Strategy” and “StarS” have advocated a move from modernization and brown development to a green model of sustainable development.

2015 UPNG School of Natural and Physical Sciences, funded by the Ministry of National Planning and Monitoring established at UPNG a full four year degree programme , a Bachelor of Sustainable Development (and a post graduate two year programme),. to be co-ordinated by the Discipline of Environmental Science and Geography

2015 Release of PNG Medium Term Development Plan 2 2016-2017 – setting a new pathway to a responsible sustainable future – *PNG ..em mi yah!*

2016 ESG at UPNG has 23 academic staff positions. It teaches 65+ courses , runs the Centre for Climate Change and Sustainable Development with projects both in PNG and in Pacific island countries. It runs a mainstream ESG programme covering environmental science, geography and GIS and remote sensing, a Bachelor of Sustainable Development programme, and a Diploma in Comprehensive Hazard and Risk Management (Dip-CHARM). See Appendix Boxes xxx

2017 It is proposed that ESG run a nation wide “StaRS awareness programme” focused on regional centres and leaders to students and women's and church groups, with “StaRS ambassadors and co-educators.

2017 The Department of National Planning and Monitoring will run a series of workshops around the country to develop a mechanism for incorporating the 17 sustainable development goals into the PNG planning process, and will publish this as the next Medium Term Development plan 2017-2020,

2018 It is planned that the two introductory Sustainable Development courses together with the introductory Environmental Science courses be taught from all UPNG provincial university centres throughout the country.

2018 ESG will run , together with its Bachelor of Sustainable Development programme, with the School of Law will run a LLB Bachelor of Sustainability Law Degree programme, a Bachelor of CHARM and if funding is available a Diploma in Physical Planning, and will assist the Biology Discipline in a Post Graduate Degree and Diploma in Conservation Management and Development.

(modified in June 2018)

At independence, Papua New Guinea's founding fathers had the foresight to enshrine environmental and sustainability concerns in the national constitution. The five National Goals and Directive Principles of Papua New Guinea's constitution reflect a commitment to sustainable development. The fourth is about natural resources and environment, as set out in Box 4 below:

Box 4

PNG's Five National Goals and Directive Principles

1. **Integrated Human Development** – providing all citizens with the opportunity to achieve their potential. Quality education and a world class health system are key elements of the PNGDSP for human development, helping to develop a highly skilled work force and equipping PNG's entrepreneurs with the skills they need to grow their businesses.
2. **Equality and Participation** – all citizens should have equal opportunity to participate in and benefit from the nation's development. Prosperity in rural areas of the country where the majority of citizens live.
3. **National sovereignty and Self-Reliance** – to be strengthened by PNG's economic and political success. Good governance and broad based growth will help build PNG into a prosperous nation including by facilitating PNG investors. Among other things, PNG's prosperity will alleviate the country's reliance on aid.
4. **Natural Resources and Environment.** PNG is well endowed with a wealth of natural resources. These resources must be managed sustainably to ensure they benefit both future and current generations. In particular, resource revenues need to be focused on nation building, whilst at the same time protecting the environment.
5. **Papua New Guinean Ways** – PNG has a rich heritage of traditional wisdom and knowledge, reflecting the greatest cultural diversity of any nation of the world. PNG's development will be fostered in ways that learn from and build upon PNG's cultural heritage. Policy measures for law and order, land, education and health, need to draw upon PNG ways to improve the effectiveness of service delivery in these sectors.

The fourth goal in particular sets out the Sustainable Development platform for growth and improvements in quality of life and environment protection.

We declare our fourth goal to be for PNG's natural resources and environment to be conserved and used for the collective benefit of us all, and to be replenished for the benefit of future generations.

This is a clear statement for sustainability and sustainable development.

We accordingly call for:

1. Wise use to be made of our natural resources in and on the land or sea bed, in the sea, under the land, and in the air, in the interests of our development and in trust for future generations; and
2. The conservation and replenishment, for the benefit of ourselves and posterity, of the environment and its sacred, scenic and historical qualities, and
3. All necessary steps to be taken to give adequate protection to our valued birds, animals, fish, plants and trees.

The fifth National Goal (Papua New Guinea Ways) also emphasized the need to use Papua New Guinean ways or organizational forms, and public participation was stressed in the second National Goal (Equality and Participation). The first National Goal is about Integral Human Development. These concepts were to be embodied in decision-making. Perhaps we still need to implement these goals.

In 1992 The PNG Government attended the Rio Earth Summit. The PNG Government was led by the then Governor General Sir Wewa Korowi. At Rio PNG signed the five main instruments listed in Box 5.

Box 5 The Rio Instruments, UNCED 1992

At the United Nations Conference on Environment and Development at Rio de Janeiro in 1992 all 180+ the countries present adopted the following five instruments:

1. Agenda 21 – the Global Strategy for Sustainable Development for the 21st century
2. Rio Declaration, also known as the “27 Principles” or the “First Earth Charter”
3. The Biodiversity Convention
4. The Climate Change Convention.
5. The Statement on Forestry Principles.

For 1 and 2 see Regency Press (1992) in Appendix Box 10.

PNG's first National Strategy for Sustainable Development followed on from its commitments given at Rio. PNG established its own Agenda 21, its own National Strategy for Sustainable Development. This was launched after the 20th Waigani Seminar on “From Rio to Rai: Environment and Development in PNG”. It was called “*Stretim Nau Bilong Tumora* (ES UPNG and Policy Co-ordination and Monitoring Unit 1993) and was supported by the action plan entitled “*Yumi Wankain*” (PM's Department and UNDP 1994). This conference was held a year after the Rio Conference, as PNG's response to the challenges from Rio. It was held both at the university in Port Moresby and also at a number of regional centres, including in the following provinces: Eastern Highlands (Goroka University), , Western Highlands (Mount Hagen), West Sepik (Vanimo), Manus (Lorengau), Madang (Madang), Morobe (UOT, Lae) , East New Britain (Malaguna), Bougainville (Hutjena), and Western Province.(both Kiunga and Daru). Representatives from the following provinces also presented papers: Simbu, East Sepik, New Ireland and West New Britain,

The philosophy behind this Waigani seminar was that in PNG any strategy for sustainable development requires the participation of grass roots people and those from the provinces and villages. Hence it was held also outside Port Moresby. (See Darren Gladman, David Mowbray and John Duguman 2006). volume 1 “From hearts and minds”. This would ensure **From Rio to Rai!!** (See Darren Gladman, David Mowbray and John Duguman 2006). volume 6 “ From Rio to Rai to Reality”. See Appendix Box 10.

Papua New Guinea produced its own national report for the 1992 World Summit on Environment and Development, at Rio (Unisearch PNG 1992) and the Governor General Sir Wiwa Korowi and the Environment Minister led a high-powered delegation from Papua New Guinea to the Summit. Papua New Guinea signed the various Rio instruments, committing itself to the global strategy for sustainable development as well as committing itself to a PNGian strategy (personal communication, Department of Environment and Conservation and Department of Foreign Affairs 1992). In 1993 Papua New Guinea developed its own National Sustainable Development Strategy published together as *Stretim Nau Bilong Tumora* and *Yumi Wankain* (as mentioned above). . The University of Papua New Guinea (UPNG) assisted this process by running the annual Waigani Seminar on the theme, “From Rio to Rai: Environment and Development in Papua New Guinea” . Proceedings were published by the same name (Darren Gladman, David Mowbray and John Duguman , 1996) :

Rio to Rai books are

- volume 1. From Hearts and Minds (opening speeches, provincial seminars, people, participation and responsibility)
- volume 2. Voices Unheard and Unheeded (biodiversity and conservation, customary knowledge and practice, education, tourism)
- volume 3. A Quarter of Next to Nothing (agriculture and biotechnology, forestry, fisheries)
- volume 4 Warning Bells (mining and petroleum, chemical and waste management)
- volume 5 The Environment Strikes Back (water, urban settlements, health and sustainable living)
- volume 6. From Rio to Rai to Reality (economics and business development, essential means, closing speeches, the National Sustainable Development Strategy).

These developments are outlined in various documents: *Stretim Nau Bilong Tumora* (Department of Environmental Science University of Papua New Guinea and Policy Co-ordination and Monitoring Committee of Department of the Prime Minister and NEC,1993); *Yumi Wankain* (United Nations Development Programme (UNDP),1994) and Mowbray and Duguman (2004/2009). At the same time a group of PNG NGOs published their own set of guiding principles outlined in their “The Papua New Guinea Mama Graun Tribal Charter”.(PNG NGO Environment Watch Group, 1992, republished in 2002).

This commitment to sustainable development was reiterated when Papua New Guinea's National Executive Council (NEC) endorsed the National Sustainable Development Strategy in 1994. The National Sustainable Development Strategy was a programme of comprehensive capacity building and support for resource and environmental planning, development and management. It was Papua New Guinea's ‘Agenda 21’, our response to the commitments given by the government at the Rio Earth Summit in 1992 and a reaffirmation of the Five Goals and Directive Principles of the National Constitution. It was our commitment to sustainable development (ESD), the creation of a process for “an ecologically and economically sustainable, socially equitable society” (Diesendorf and Hamilton, 1997).

For PNG, the Sustainable Development Strategy waned through the years . The activities and recommendations generated by both Rio and by the 1993 Waigani Seminar then seemed to have been largely forgotten, or at least given very low priority. The National Sustainable Development Strategy became caught up in a number of government changes, ministerial and departmental reshuffles, ending in the Department of National Planning and Implementation. It is only in 2014 that it has now been resurrected (albeit in a much better form), culminating in the PNG government policy on Responsible Sustainable Development (RSD) advocated by Minister Charles Abel (See Box 1 and Abel 2014a,b ; also see Department of National Planning and Monitoring, 2014a,b). This was again updated in 2015 with the release of StaRS (2015). More on this later.

Some of the outcomes from this first National Sustainable Development Strategy are reflected in the (1) 1998 Papua New Guinea Human Development Report (Office of National Planning 1999) and updated version 2014 (Glenn Banks, personal communication, 2014); and (2) the Papua New Guinea Population Policy (Department of Planning and Monitoring 1999, updated in 2010). In 2000 Papua New Guinea also committed itself to the United Nations Millennium Development Goals (UN 2000, UNDP 2003) (See Box 8) and published its own PNG Millennium Development Goals (Government of Papua New Guinea and United Nations in Papua New Guinea ,2005). This was updated in 2010 with the second version of the PNG Millennium Development Goals in the national progress comprehensive report (Government of PNG and UN in PNG, 2010). A final summary report for PNG on the Millennium Develop Goals was published in 2016, though dated 2015.

Through 2005–2006 various workshops were held in Papua New Guinea involving government

departments and including other Pacific nations on ‘mainstreaming environment into development planning’ (Saulei personal communication, 2005;) (Banga personal communication, 2006). In January 2006, through funding from the Global Environment Facility (GEF), the Papua New Guinea government, working with Columbia University and local Papua New Guinea stakeholders/ participants, initiated a strategy to implement Goal 7 of the Millennium Development Goals — ‘ensure environmental sustainability’ (Melnick et al. 2005). Both DEC and UNDP regarded this as a high priority and had initiated activities in both waste management (DEC, Joku personal communication 2006) and in broadening the parameters to be considered (UNDP, Bade personal communication 2006).

One very positive step was the acceptance by The PNG Government on an *aspirational* statement in 2009 called “Vision 2050”. This is elaborated on by Mowbray (2015a and Mowbray 2016b) and a small summary of a modified Vision 2050 ICONIC statement that was created by the 2015 BSD students in our programme. The modified aspirational statement is given in Box 6

BOX 6 Revised Vision 2050

giving extra icons

to be smart, fair, happy, wise, healthy, *maintain spirituality, maintain cultural diversity, maintain a sustaining environment, good governance, empowerment (including women), equality, 'enoughness' or well-being.*

(those in italics added by UPNG BSD students, 2015)

A second statement that PNG could well seek to follow is the **2000 Earth Charter**. It is in many people's opinion the best international statement on “sustainability”, “*The Earth Charter*” orchestrated and presented to the international community by Maurice Strong (Canada) and Mikhail Gorbachev (Russia). This statement incorporated (1) respect and care for the community of life”, (2) ecological integrity, (3) social and economic justice, (4) democracy, non-violence and peace, and (5) a statement on the way forward.

Extracts are given in Box 7.

Box 7

The 2000 Earth Charter – an international statement on sustainability, orchestrated by Maurice Strong (Canada) and Mikhail Gorbachev (Russia).

Some extracts from the Preamble

We stand at a critical moment in Earth’s history, a time when humanity must choose its future... We must join together to bring forth a sustainable global society founded on respect for nature, universal human rights, economic justice and a culture of peace. Toward this end, it is imperative that we, the peoples of the Earth, declare our responsibility to one another, to the greater community of life, and to future generations.

Expanded document

This statement then expands on the following:

(1) respect and care for the community of life”, (2) ecological integrity, (3) social and economic justice, (4) democracy, non-violence and peace, and (5) a statement on the way forward.

In concluding...

Let ours be a time remembered for the awakening of a new reverence for life, the firm resolve to achieve sustainability, the quickening of the struggle for justice and peace, and the joyful celebration of life.

Reference

Earth Charter 2000. The Earth Charter, Earth Charter Institute; on line available at www.earthcharterinaction.org/content/pages/Read-the-Charter (pdf document)

PNG is also now committed to the Sustainable Development Goals for 2016-2030. Although we achieved none of the eight MDGs, PNG has committed itself to achieve all of the 17 SDGs. In the *National* newspaper on Friday October 28 on page 22, quoted National Planning and Monitoring Minister Charles Abel (*The National* 2016) attended a meeting convened by NGO Marie Stopes on family planning and reproductive health care and the need to support the national family planning policy (NFPP) of 2014. He said that family planning generated benefits for society as a whole as it has on life-changing impacts on individual lives. He added that most of these issues are targeted by the new United Nation Sustainable Development Goals (SDGs). He said that PNG was now incorporating the SDGs into its development plan (StaRS) and into the medium term develop plan (MTDP) which was going to be a 5 year road map for the incoming government to ensure that the development plan coincided with political goals. The Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs) are listed in Box 8.

Box 8

The Millennium and Sustainable Development Goals- MDGs and SDGs

Millennium Development Goals (MDGs) 2000-2015	Sustainable Development Goals (SDGs) 2016-2030
Eradicate extreme hunger and poverty	End poverty in all its forms everywhere
Achieve universal primary education	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture
Promote gender equity and Empower Women	Ensure healthy lives and promote well- being for all at all ages
Reduce child mortality	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all
Improve maternal health	Achieve gender equality and empower all women and girls
Combat HIV/AIDS, malaria and other diseases	Ensure availability and sustainable management of water and sanitation for all
Ensure environmental sustainability	Ensure access to affordable, reliable, sustainable and modern energy for all
Develop a global partnership for development.	Promote sustained, inclusive and sustainable

	economic growth, full and productive employment and decent work for all
	Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation
	Reduce inequality within and among countries
	Make cities and human settlements inclusive, safe, resilient and sustainable
	Ensure sustainable consumption and production patterns
	Take urgent action to combat climate change and its impacts
	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
	Protect , restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss.
	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels
	Strengthen the means of implementation and revitalise the global partnership for sustainable development

Through this period a number of important regional reports were also published. These included '*The Pacific Way*' (SPREP, 1992) and associated report Environment and Development. A Pacific Island Perspective (ADB, 1992); also the '*Pacific Plan*' (Pacific Island Secretariat, 2005) and the very recent '*Framework for Pacific Regionalism*' (The Pacific Plan Review and the Forum Secretariat, 2014). PNG is a partner in all these.

PNG Problems and Blocks on Sustainable Development

Despite a commitment to sustainable development, over the years PNG has made many mistakes by doing things inconsistent with that commitment to sustainable development. We continue to exploit our natural resource base unsustainably, especially in mining, petroleum and forestry, and use the income generated on questionable development activities which often ignore the poverty of many of our people and the decline in services, both rural and urban. A recent example is the massive infrastructure in Port Moresby of roads, sports facilities and hotels yet doctors in Port Moresby hospital have to purchase their own medical gloves as there are none in stock. In the rural areas roads remain impassable and hospitals, schools are very run down and medical services very poor. Schools and health centres are remote and often with limited if any supplies. Service delivery is very poor. So today we see massive development in Port Moresby but little in most other parts of the country where health services and schools are extremely run down. In Gulf Province health services are scarce in most parts of the province being remote for most people. No PNGian doctors want to work in isolated places like Kikori and Kapuna (with a few exceptions). This is common throughout the country. In Daru, the capital of Western Province home to the giant Ok Tedi Mine and of PNG Sustainable Development Limited, there is limited basic infrastructure and people still use black buckets or black pans for their toilet. In many of the very remote villages in PNG the people rarely if ever see Government officers or receive any services. The commitment to 'equity' and 'economic and social justice' is often ignored. Despite a commitment today to free health and education, it just is not happening. Also Environmental concerns are brushed aside in this rush for development. What do the rest of the people in Papua New Guinea think when they see or read about or are told about what is happening in Port Moresby (massive development of roads, buildings, sports facilities, infrastructure, good hospitals and excellent schools) and yet see little improvements in their own areas? Something indeed is very wrong. This is a matter of lack of social or intragenerational equity! If PNG is committed to sustainable development why is this happening or not happening??

I shall now discuss four areas of particular concern: (1) legislation introduced to fast track development, (2) DEC's withdrawal from maintaining protected areas, (3) SABLs and their continuation, (4) weak commitment to chemical management.

1. Fast-Tracking Development

The old paradigm of brown development seems to still be the norm. Attitudes and values and lack of political will to enforce environmental protection still exist. Development projects are fast-tracked, avoiding enforcing environmental legislation. This occurs from political pressures since the country continues to rely on non-renewable resources (but are their benefits being sustained?). For example, in 2010 retrograde legislation was passed by the Somare Government which gave extraordinary powers to the Secretary of Environment and Conservation to over-ride environmental legislation and took away the right of appeal by communities. It is suggested by Shearman (2013) and others (personal communication) that this amendment was at the bequest of a large mining company, who disposes its waste directly into the sea. See Box 9.

Box 9

PNG: Amendments to Environment Act 2000 – a legal view

Papua New Guinea: PNG Legal Briefing: Amendments to Environment Act 2000

Last Updated: 13 February 2012

Article by Les Gavara-Nanu

Norton Rose Fulbright Australia

Introduction

Overview of Environment Act 2000

The Environment Act 2000 (Act) is the primary legislation in PNG which regulates the environmental impact of development activities and how any adverse effects of such activities should be avoided, remedied or mitigated. Under the Act, developers must apply to the PNG Department of Environment and Conservation (DEC) for an authorisation to undertake activities which materially impact the environment. The type of authorisation required depends on the nature of the proposed activities and the level of impact involved. The Act imposes hefty fines for developers who undertake activities without an appropriate authorisation. Broadly speaking, certain activities (prescribed by the Act as 'level 3 activities') require the developer to undertake an environmental impact study (EIS), to be made available by the DEC for public review and comment, before a decision is made as to whether an authorisation should be granted. An EIS is required for 'level 3 activities' such as the submarine disposal of tailings waste from mine operations and the recovery, processing, storage and transportation of oil and gas.

Repeal of Environment (Amendment) Act 2010

The Act was amended in 2010 by way of the Environment (Amendment) Act 2010 (2010 Amendment) to allow retrospective certification and authorization of activities which may have otherwise been deemed illegal under the Act.

Pursuant to the 2010 Amendment, the Director of the DEC was granted power to:

- retrospectively certify and authorise any activity by a developer which relates to or is associated with an activity permitted by an existing authorisation, notwithstanding non-compliance with any procedural requirements of the Act;
- certify and exempt any act, work or omission undertaken by a developer which was not in accordance with an existing authorisation;
- on application by a developer, certify that a particular methodology or conduct undertaken, or proposed to be undertaken, by the developer meets the best practice standards required by an existing authorisation;
- certify and authorise an activity as being a necessary and inevitable consequence of any conduct that is permitted by an existing authorisation; and
- certify an act, work or activity as being in compliance with an existing authorisation.

Generally, the grant of a certificate by the Director in the above circumstances would:

- constitute conclusive evidence that the relevant activity is authorised and therefore lawful;
- be final and not subject to challenge or review in any court, except by the holder of the relevant authorisation (i.e. the developer); and
- constitute a bar to any claim in tort or other civil cause of action brought as a result of the activities the subject of a certificate.

In January 2012, the above amendments were proposed to be repealed in their entirety by Parliament pursuant to a bill tabled by the O'Neill Government. It is understood that upon certification by the Speaker of Parliament, the new law will come into

force immediately and will have retrospective effect.

Potential legal implications

The new law could impact the resources sector in a number of ways depending on the specific circumstances. Below are some examples of possible legal implications:

(continued) Potential legal implications

The new law could impact the resources sector in a number of ways depending on the specific circumstances. Below are some examples of possible legal implications:

- Developers could be faced with higher compliance costs for their projects – i.e. costs to ensure that their projects meet the requirements of the Act by holding the required authorisations.
- Projects which were modelled on the (now repealed) 2010 Amendment to the Act may need to be re-modelled as a result of the new law.
- Material delays to project schedules may be encountered by the need to obtain new authorisations under the Act and to satisfy the applicable requirements for such processes. This could particularly arise where an EIS is required for a current or proposed 'level 3 activity' that had previously been certified.
- Activities which had been certified by the Director could now be unlawful, thereby exposing developers to prosecution under the Act. Additionally, a past decision by the Director to grant a certificate could now be subject to legal challenge by aggrieved third parties.
- Developers could now be materially exposed to civil claims for damages (including in tort) by third parties affected by any activities that had previously been certified by the Director.

Conclusion

Developers who received certification from the Director pursuant to the 2010 Amendment should seek legal advice on the extent to which their business is impacted by the new law, and how and to what extent they can avoid or mitigate such impact. This may be particularly critical for projects in the mining, oil and gas and other sectors which regularly undertake 'level 3 activities'.

The content of this article is intended to provide a general guide to the subject matter. Specialist advice should be sought about your specific circumstances.

Thankfully in 2014 these amendments to the Environment Act were revoked by the O'Neill Government. **This sorry saga is a clear example of the government betraying its commitment to sustainable development. Environmental protection is a crucial part of implementing sustainable development. It must not happen again.**

2. DEC 's withdrawal from supporting Conservation and Protected Areas.

In another area, since the early 1990s DEC had basically ceased supporting protected areas (PA's) throughout the country with a few exceptions. This and other sad stories of the weaknesses of DEC are outlined in Shearman (2013). Most protected areas now exist on paper but not in practice. Few DEC staff are in the field supporting protected areas and provide basically no support to landowners and local communities. Most national parks, wildlife management areas and other

protected area receive no financial or staff support , except for some from either PNGian or international conservation NGOs. Likewise for marine conservation or protected areas.

This is now changing with JICA assistance as PNG DEC now Conservation and Environment Protection Authority (CEPA) has recently committed itself to re-establishing and strengthening protected areas (reported in *Post Courier* and *National*, in October 2014 with the example of Varirata National Park. And just last week in October 2016 to Hiri Marine Protected Area off Motupore Island Other strong protected areas are the Yus Conservation Area and the Exxon-Mobile supported Lake Kutubu WMA. CEPA has reentered the Conservation Area. This is most welcome. **This recommitment to biodiversity conservation and protected area management and new partnerships in conservation were clearly stated by the DEC presenter at this workshop** (presented in MLT at UPNG on Thursday 20th November 2014, and published in these proceedings in volume 1). This will be a key policy area for the new 2015 Conservation and Environmental Protection Authority. **Biodiversity conservation and an effective protected area management system are crucial parts of a sustainable development strategy.**

3. Special Agricultural and Business Leases (SABLs)

This is a very sorry continuing saga. Special Agricultural and Business Leases (SABLs) were established a few years back and although found to be “corrupted” and avoiding important environmental, forestry and agricultural legislation are still operating although the Prime Minister almost 18 months ago promised to rescind them or most of them immediately. No action has been taken to date to suspend them though the Prime Minister still insists today that they must be revoked. Much has been written on this in the PNG press and in particular on the PNG blog *png exposed blog* (Peter O'Neill's illegal logging 508 days and counting, on 15th November 2014 on www.pngexposed.wordpress.com). A summary of the final SABL report is given on www.pang.org.fj/summary-of-the-final-sabl-report-png/. See also www.en.wikipedia.org/wiki/Deforestation_in_Papua_New_Guinea. In this last report it covers PNG Government turning forest assets into carbon trading revenue through the REDD programme. The SABL “sorry story” is a dramatical example of a government going against its policy of sustainable development **as nothing is more unsustainable than logging and SABLs in PNG's forests!!** (also see Phil Shearman et al, 2008). **SABL's must be immediately revoked and sustainable forestry and agricultural practices invoked.**

4. Weak commitment to chemical management aspect of environmental protection.

The author, with almost 35 years of working with DEC (from 1978 to 2008, 2014) has never seen a prosecution for infringement to the Environmental Planning Act, Environmental Contaminants Act now amalgamated (with the Water Resources Act) into as the Environmental Act 2000. This has been confirmed to me by colleagues both in DEC and by colleagues at UPNG who used to work in DEC. Furthermore DEC has never since when the Environmental Contaminants Act was passed in 1978 (replaced by Environment Act in 2000) made a prosecution for environmental pollution. The possible exception was when the PNG Government closed the Ok Tedi Mine down in the early 1980s due to its disposal of tailings into the Fly River but this was only temporary and never resulted in any prosecutions. Landowners have sued BHP and Ok Tedi in Australian courts for polluting the Fly River. I have been told of other possible prosecutions for environmental pollution but these never eventuated. These included a large mining company and smaller industries. I have also heard quite a number of times over the year of decisions being made at a political level before DEC can investigate or during the investigation and review time.

DEC has failed to mitigate, control or regulate adequately industries both large and small relying too often on self regulation which only works when you have socially responsible companies. Some large international companies like Exxon Mobil produce quarterly social and environmental reports (eg on the web is the second quarterly report for 2014 at www.pnglng.com/images/environmental_pdfs/Q2_2014_ES_Report_Final_Full.pdf) . Others like Placer / Barrick produce annual sustainability / responsibility reports (latest available on the web at www.barrickresponsibility.com go to environment and social impact assessment at www.barrickresponsibility.com/additional_information/environment/environment-and-social-impact-assessment/). PNG Power is proactive in dealing with old transformers and PCB wastes (see Ben Tolimanaram , 2005). New Britain Palm Oil also produces sustainability reports covering both social and environmental aspects , available at www.nbpol.com.pg New Britain Palm Oil, 2011). They also pride themselves in their ISO 14000 accreditation.

A bad example of environmental contamination and a real risk to the community is the many old timber treatment plants around the country. Many of these sites have been abandoned, few if any remediated. An example from Port Moresby is the Forestry Department former treatment plant at Hohola. Forestry is reprehensible in how it dealt with a contaminated site in this old timber treatment plant in the Port Moresby suburb of Hohola. For years (in the 1980s through to the early 2000's overflow from this plant flowed into a creek where people picked *kangkong* and where children played. It contained copper-chrome-arsenic and was almost fluorescent blue-green. The waste from the sedimentation pit was thrown onto the ground beside it and beside food gardens. People lived in the same building as the treatment plant (the other half!). Forestry sold the site without any remediation work. It now is the site of new housing and business estate. In Australia where the same thing happened the houses had to be abandoned twenty years later because of persons living there being poisoned. Forestry was advised to clean the site or fence it off, but never did!

Many companies particularly smaller ones, and in particular the workers often do not know what chemicals they are using or call 'confidentiality' as they regard what they use a trade secret. The new regulations and guidelines on chemicals will change all this!! Chemicals legislation to date has only controlled pesticides and water quality through the existence of guidelines. Even today we have no guidelines on other chemicals, though this is about to change (see below). But a vigorous training and education programme needs to be conducted by DEC to train people in safe use and recognition of chemicals.

Another real potential problem in PNG is that of asbestos as old houses, school buildings and hospital / health centre facilities deteriorate with age, and as PNGians grow older. The Health Department has paid consultants to assess the situation in PNG. (noted in *Post Courier* advertisement in late October). But little information is available to the public. It could be a real risk. A real problem is also lack of communication between government departments. For example DEC and NCD Health knew nothing about the Health Department's proposed consultancy on asbestos.

The lack of both an updated register of all chemicals coming into PNG and the lack of guidelines means the Environment Act remains unable to be enforced which means that the Act remains largely impotent. Mowbray noted this 15 years ago, published both in 2000 and 2004 the PNG Chemical Management Profiles (latest on UNITAR website is David Mowbray, 2004 at www2.unitar.org/cwm/nphomepage/ go to PNG or at www2.unitar.org/cwm/publications/cw/np/np_pdf/PNG_National_Profile.pdf

It also appears at SPREP website arsenic.ddo.jp/samoa/...08-PNG/PNG_Chemical_Profile-

2005dcopy.pdf. The older PNG National Chemical Profile is no longer on the web. However 10-15 years after these documents were published basically all of the 38 recommendations have not been acted on. PNG is a signatory to three of the four important international conventions relevant to Pacific countries on trade in chemicals (available from SPREP and NTN on a disk or see Chemical Convention Handbook at NTN Australia web address: www.ntn.org.au/toxic-geeks/chemical-conventions/). PNG has signed the Stockholm Convention (on persistent organic pollutants or POPs), the Basel and Waigani Conventions (both on waste) but has yet to ratify the Rotterdam Convention on prior informed consent (PIC), though I am told this is now about to happen.. This was recommended a number of times the most recent 10 years ago! Despite great value for PNG if it were to do so. See National Toxic Network and Mowbray (2014). The irony is that the author represented SPREP and UNEP on the committee that originally established the Rotterdam Convention. By signing the conventions PNG is obliged to implement them. In the area of other chemicals we do not know what is entering PNG. As mentioned the exception is for pesticide management where the appropriate regulations and guidelines have ensured that many highly hazardous pesticides are no longer imported into PNG; however even here improvements are needed to the registration system and checking for compliance to the FAO Code of Conduct on Distribution and Use of Pesticides now known as the Code of Conduct on Pesticide Management. Such improvements could lead to lesser risk from pesticide use in PNG (Greenpeace 1992) and Mowbray (2014); also see www.pacifictoxicology.org or www.pacifictoxicology.org (both sites presently under construction). CEPA through a very capable officer is now trying to address these issues. I have every confidence he will succeed. Actions are now being taken also for other chemicals. A recent new regulation has been passed (to cover "other chemicals". This is the *Environment (Registration of Contaminants and Hazardous Contaminants) Registration, 2011*. The guidelines will soon begin to be drafted and it will be a long and difficult task. The author is involved in providing technical assistance for both pesticide and other chemicals management and risk reduction with CEPA's Environmental Protection section working closely with officers there (many former graduates of the UPNG Environmental Science, Biology and Chemistry programmes).

CEPA with the assistance of both SPREP and the University of the South Pacific has recently run a series of training workshops in PNG on chemical management. Xxxxx)Also the POPs project has recommenced under phase 2,

The author has also reestablished the old SPREP Pesticide Project (Mowbray 1988, SPREP, SPC , ARSAP, CIRAD 1990, 1994) under a new project working with SPREP, SPC and with the NGOs Pesticide Action Network Aotearoa New Zealand and National Toxics Network (see website www.pacifictoxicology.info and www.pacifictoxicology.info). This project is regionally based working with the 21 countries of the Pacific excluding Australia and New Zealand but includes PNG but is pro bono. The aim is to assist all countries develop registers of pesticides used in their countries, to reduce pesticide risk (for example ensure phasing out of highly hazardous pesticides used in the region, eg paraquat and imidacloprid and to develop a 'health and environmental effects' database for all pesticides used in the region. On these matters I am working closely with staff in CEPA. Over 2200 pesticides products have been entered into our database. Through student assistance in the ESG Pollution Science course students are assisting in developing a new pesticide register for vall pesticides in PNG. Students in 2015 and 2016 have / will survey the whole country to determine what pesticides are actually used today in PNG. This ought be complete by mid 2017.

Much needs to be done to have good chemical management in PNG, but I am confident this will happen but will take time and effort.

Conclusion on blocks on Sustainable Development.

The above four examples of the “crazy” amendment and subsequent revoking of these amendments to the Environment Act, the SABLs, lack of support for conservation policy and the inability in the past to implement chemical management (except for pesticides even 35 years after the Act was passed into law in 1978) are clear examples of what should not happen in a country with a national strategy for responsible sustainable development. This must change. I have every confidence it will!

Role of CEPA

It is clear that to carry out its mission and responsibilities CEPA needs more financial and man / woman power resources, a commitment to its mission and no interference from political leaders. CEPA has a special role to play in the pathway to sustainable development in PNG. It needs all the support it can muster. In fairness to CEPA, to quote a former student of the author's who did her ESG work experience there in 2008:

“there is a lack of funding for both traveling and monitoring purposes and office equipment – often computers riddled with viruses (and computers crash!) and no or little internet connection. These may seem an expense to the government but it would make a lot of difference to time management and productivity of the work force. In conclusion the department does carry out its responsibilities to the best of its resources and funding. It would be able to do more but the issue of funds, equipment and an adequately skilled workforce need to be seriously looked into by the government and improvements made ...”

quote from Ramphaey Gime (personal communication), December 2008.

The Department of Environment and Conservation is now the Conservation and Environmental Protection Authority. It clearly needs more adequate funding so it can do its job of monitoring conservation and environmental protection throughout the country on a regular and well planned approach / strategy as well as being a key partner in the new Responsible Sustainable Development Strategy.

If PNG is to attain ESD and have an effective national responsible sustainable development strategy it must be wary of taking shortcuts and fast tracking development. Such is contrary to proper ESD practice, and often leads to corruption and unsustainable activities and associated environment, social and economic costs, the environment and the community bearing the brunt. It must learn from past mistakes and not repeat them. The Conservation and Environmental Protection Authority (CEPA) and the Department of Planning and Monitoring both have special responsibility as they are the two key departments responsible for implementing the National Strategy for Responsible Sustainable Development in the key areas of social, environmental and economic sustainability and in good governance, especially environmental governance or governance for sustainability..

Generic Problems PNG faces

There are four other problems that a country like PNG faces in implementing a sustainable development strategy. These are discussed in article by Victoria Elias in Felix Dodds (ed, 2000). She discusses four major barriers that countries like PNG face and slows down the move towards a sustainable society. These are: (1) the lack of peace and security within the country; a real problem throughout PNG; (2) lack of resources by implementing department or agency such as CEPA and DNPM; again a real problem in PNG; CEPA lacks the resources to implement its mission on conservation and environmental protection let alone be a major player in the implementation of

ESD; (3) lack of public involvement and access to information and public participation in decision-making processes; a real hurdle to overcome in PNG – needs much more formal and informal education, awareness raising and training in skills, and (4) language problems for non-English speakers as most PNGians speak mainly *Tok Pisin*, apart from the 850 odd other language groups.

Two further notes.

First note: Emphasis on Economic Growth

There is a continuous call for increased economic growth in PNG by all leaders, the private sector and community leaders ; and they are referring to economic growth under brown development paradigm - based on unsustainable resource use. The belief is that the benefits from increased economic growth will trickle down to all Papua New Guineans. This is a myth that economists have championed throughout all time. The world today consists of very rich and overdeveloped countries with ecological footprints far in excess of their biological capacity and very poor countries often with low ecological footprints but with much poverty. PNG specifically is a country of the very rich and the very poor. Great infrastructure in Port Moresby and little in the provinces and local government areas and villages. Clearly there is a very little trickle down effect. The life style of the few rich and their ecological footprints far exceeds the carrying capacity of the environment to supports them and is unsustainable. The ordinary villagers live relatively simple lives, have a small ecological footprint and in general live sustainably. Despite the hype and the rhetoric the benefits of PNG's increasing GNP / economic growth rarely touches many of them. Moreover economic growth is based on extraction of non-renewable resources eg minerals and oil and on unsustainable logging and agricultural practices. Our leaders may differ with my view. The important consideration in this context ought be improvements in human development, economic growth is only a means, improved human development ought to be a major objective as well as environmental sustainability. PNG must aim for what Mahatma Gandhi termed 'enoughness' a term commonly used now by those concerned with sustainability issues. Minister Charles Abel is one who clearly recognises this and instead emphasises the need for a new PNGian way of doing things under the paradigm of green development.

At present in PNG our economic growth rates are high and unprecedented riding on a mineral and particularly oil boom. See Box 10 with quotes from Prime Minister Peter O'Neill taken from recent newspaper cuttings. But the ride will only last for a finite period of time and will end. PNG must avoid the “*Dutch Disease*” or resource curse where the downside of economic growth rears its ugly head. See Box 11 of quote from the editorial of the *Sunday Chronicle*, Sunday November 9, 2014 and that in Box 12 from the adviser to the National Planning and Monitoring Department's adviser on Responsible Sustainable Development.

The Asian Development Bank (2014) in a recent critical review states that challenges that PNG faces include (1) ensuring that the recent higher economic growth rates are sustainable in the medium to long term, and (2) translating high economic growth into more more inclusive development than has prevailed to date. They found the most critical constraints were

- weaknesses in governance and institutions, particularly those relating to delivery of public services, maintaining law and order, controlling corruption, and managing land and land titles;
- poor infrastructure and infrastructure services, particularly in the case of transport, electricity and water supply;
- shortages of skilled human capital, and poor and unequal access to affordable and quality education; and
- lack of and unequal access to affordable and quality health services.

They state that by overcoming these impediments “will help” PNG achieve more inclusive economic growth that will provide the country's citizens with more equitable shared opportunities to contribute to and benefit from economic growth”. But I ask will this happen under the old paradigm which has not delivered these to date?

It must further be pointed out that continuous economic growth (under the old paradigm of brown development) is a contradiction in terms to the process of ecologically / responsible sustainable development. Whereas PNG now needs a continuing economic growth to provide the benefits that Vision 2050 aims for, but not the pollution and unsustainable use of minerals and oil, in the long run the PNG economy must transform itself into a process that aims for green economic strategies/ processes with strong (not weak) economic sustainability and environmental / ecological sustainability (and social sustainability). Only then with social and environmental sustainability and good governance will we be on the road from Rio to Rai to now to ESD.

Second Note: the need for more education and training and awareness raising

If PNG is to move along the road to ESD **then it must believe in it.** Most of the people must believe in it. Minister Abel certainly does. The community and villagers too must all believe in ESD or in responsible sustainable development. **It must be the road from Rio to Rai to now to ESD to ples.** The ideas must be spread throughout all PNG from the cities to the remote villages; from Port Moresby, Lae, Kokopo, Alotau, Goroka, Mt Hagen, Daru, Kerema, and Madang and other main towns to Rigo and to Rai and to BogaBoga on Cape Vogel and all the remote villages on islands and in the mountains, along coastal strips and along rivers. This is why education for sustainable development is so important (see Commonwealth Secretariat , 2013.) But those taking out the message must be passionate communicators , have high ethical standards and live consistently by the message they spread. At schools and universities sustainable development requires a greater focus across all disciplines. Educators need also use the media and in particular the social media which has spread so rapidly throughout PNG in recent years. Sustainable development and ESD includes a bottoms up and not top-down process of decision-making – the community, and those in the villages and not just the leaders need be involved in important decision-making. However we still need commitment and political will from our political leaders. Without this the strategy will not work. Charles Abel, the Minister for National Planning and Monitoring has committed himself and his department to achieving just this. They believe in the new paradigm of 'green development'. **We must too.**

Just now UPNG ESG is planning to work with both DNPM and UNDP on embarking on a nation wide StaRS awareness activity right across the country in 2017 focusing on regional centres, provincial government and local level government leaders, NGOs and churches and village communities. We hope to use NGOs and church groups as “StaRS ambassadors or co-educators.

In their mission statements CEPA for many years has in theory committed itself to the ESD process. Political parties must do the same. Globally all Greens parties have done just that, In Australia the third largest political party with 11-15% of the national vote at both state and federal levels is committed to ESD (see NSW Greens website at www.greens.nsw.org.au). Its mission is to bring about social and political change with adherence to four key issues: peace, non-violence and disarmament; social equity and economic justice; participatory democracy; and ecological sustainability. In NSW one member of the Upper House is the Greens environment spokesperson Dr Mehreen Faruqi herself an environmental engineer and environmental scientist and co-author of the latest edition of a key text book used in courses in ESG at UPNG (Harding, Hendriks and

Faruqi, 2009). Earlier this year (in early 2014) she moved a motion in the NSW Upper House that “the NSW State Parliament reaffirm its support for the Australian Government commitment to Ecological Sustainable Development”. The motion was supported by Labor and the Greens but outvoted by the conservatives including the Liberals and so lost. The past Australian Labor Government supported by the Greens had a policy for Ecologically Sustainable Development though often erred from it, but it had a policy!. Environment Australia has produced a plethora of excellent documents on all aspects of ESD and implementing it and related publications on sustainable population and sustainable living (eg see The Present Sustainable Population Strategy for Australia -2011 Sustainable Population Strategy for Australia document

<http://www.environment.gov.au/resource/sustainable-australia-sustainable-communities-sustainable-population-strategy-australia> Australian Government Productivity Commission: or

A 'Sustainable' Population? - Key Policy Issues - Australian ...

<http://www.pc.gov.au/research/conference-proceedings/sustainable-population>)

After returning from the Paris Climate change conference where it signed the agreement to limit temperature rise and where it acknowledged the concerns of low lying countries not to go above a 1.5OC rise, the Australian Government announced it would approve the large coal mine (on the Barrier Reef). What hypocrisy!!

By its actions it is clear that the present Australian Government is not committed to ESD but accepts the old paradigm of brown development, a large and unsustainable ecological footprint and overdevelopment and too-muchness. It is only prepared to offer crumbs in international development assistance and give voice agreements to international agreements., unless it sees that something as in its economic or strategic or other interests.

In PNG the fledgeling PNG Greens Party has a similar mission with a clear commitment to ESD in Papua New Guinea (see website: www.pnggreensparty.org.pg. This is a new website and is under construction). Its draft mission statement (which its members need to discuss) is:

That the PNG Greens Party will strive to ensure that:

- *PNG has an ecologically sustainable future,*
- *the quality of life will improve for all PNGians,*
- *PNGians live within the carrying capacity of our supporting ecosystems*

so

- *all PNGians now and in the future will be healthy, happy and wise and our environment remains healthy.*

But Green Parties have not been successful in developing countries, including the Asia Pacific region (Jackson and Bhathal, 2013). The PNG Greens Party is a fledgling party and very small and presently faces deregistration due to its failure to comply with the Organic Law on the Integrity of Political Parties and Candidates 2003 (OLIPPAC Law), and amendments to that law in 2014. These relate to bank accounts, finance, number of financial members and other legal and technical matters and requirement for annual meetings

It would be great if our political leaders who have all supported this new way forward, the National Strategy for Responsible Sustainable Development (RSD), were to be more vociferous in their support and that they start to think and act in the new paradigm. It is believed that there is a grouping of such persons in the Government who believe in the new paradigm of green development. These leaders who have pledged their support to the new paradigm through the *Alotau Accord* must also pledge their political groupings in PNG to adopt similar mission statements and a policy of support, not just for Vision 2050 but also to the newly propose national

strategy for responsible sustainable development or RSD. They need to accept and adopt the new paradigm. In PNG we need strong political will and a grassroots support for ESD and RSD!!

Box 10.

Quotes from Prime Minister Peter O'Neill on Economic Growth.

Quotation from PM Peter O'Neill from PNG *Post Courier* Friday November 7, 2014 Front page

We're on track. Growth higher than expected. ...ensuring an economic growth around 5 per cent in 2014.... ..be assured that growth will be high

Quotation from PM Peter O'Neill from *The National* Friday-Sunday November 7-9, 2014 Front page

Prime Minister Peter O'Neill has assured the nation that the economy is on track, with the Government expected to achieve growth levels "unprecedented anywhere in the world".

Quotation from PM Peter O'Neill from front page story of Sunday Chronicle, Sunday November 9, 2014

"Economy healthy, economy will grow to unprecedented levels"

"Economy healthy" The Prime Minister Peter O'Neill says Papua New Guinea's economy is very healthy and will grow to unprecedented levels. "We will achieve growth levels that are unprecedented anywhere in the world this year and onto next year," he said.

"The PNG economy's growth will be much higher than what we have projected as a result of good management of the economy by our government.... it is planned to create an environment where employment continues to grow and make sure that the economy grew at 5% this year."

" We are spending money where we stated in the budget documents..that is on education,.. on health, .. on infrastructure,.. we are running the economy of our country in a responsible manner ...we can create more jobs for our people, we can create more opportunities for our people and we can build a very good society for our kids."

Quotation from PM Peter O'Neill from *The National* Tuesday November 11, 2014 page 3

"O'Neill: Be inclusive with growth"

Prime Minister Peter O'Neill says reducing inequality means giving the people support and developing necessary skills they need to contribute to the economy.... inclusive growth related to PNG's approach to economic development...we must be inclusive with the growth we're experiencing so that it is shared by all".

He said reducing inequality required attention to core services which empowered people to take part in the economy such as healthcare, education, law and order and infrastructure.. Access to universal healthcare is enabling our people to be more healthy so that they can be productive in the economy and this helps their community. Education and skills training is essential to empower the next generation when they leave our schools.. We have implemented a free education policy so all PNG children have to go to school. This will advance literacy rates and so we will have a much better educated and trained population.. We have increased our spending on law and order initiatives and this is making the places people live and work safer. The provision of new infrastructure was essential but it had to not just be in major cities.. We are putting national government funds into local level projects.

Box 11

Downside of Economic Growth -

Downside of economic growth

from the editorial of Sunday Chronicle, Sunday November 9, 2014
page 10.

OUR economy continues to grow in 2014 largely supported by the gas and mining sectors. Our economic outlook continues to remain positive in 2014 with the domestic economy projected to grow at 6.2 per cent, representing 14 years of uninterrupted economic growth.

The strong growth is supported by the gas and petroleum sector with the production and export of PNG LNG project gas; it is also supported by a rebound in the mining sector as key mines return to normal production in 2014 after the disruptions encountered in 2013.

Nickel production is also expected to ramp up to over half of full capacity lifting total output from the sector in 2014; and the agriculture, forestry, fishing sector, and other non-mineral sectors are also expected to record positive growth rates in 2014.

What does this mean to Papua New Guinea? Of course it means more wealth for the country. This enhances the country's potential for reducing poverty and solving other social problems. There is some significant level changes taking place in the country and the future looks good. But the country should be aware of the downside of such economic growth.

As the links between economic growth and social and environmental issues are better understood, experts including economists tend to agree that this kind of growth is inevitably unsustainable. - that is, it cannot continue along the same lines for long. First, if environmental and social/human losses resulting from economic growth turn out to be higher than economic benefits (additional incomes earned by the majority of the population), the overall result for people's wellbeing becomes negative. Thus economic growth becomes difficult to sustain politically. Second, economic growth itself inevitably depends on its natural and social/human conditions. To be sustainable, it must rely on a certain amount of natural resources and services provided by nature, such as pollution, absorption and resource regeneration.

Moreover economic growth must be constantly nourished by the fruits of human development, such as higher qualified workers capable of technological and managerial innovations along with opportunities for their efficient use, more and better jobs, better conditions for businesses to grow, and greater democracy at all levels of decision-making.

Box 12

More on the Downside of Economic Growth

Country too dependent on minerals

quotations from National Planning and Monitoring department's responsible sustainable development strategy adviser Allan Bird *from The National, Monday November 10, 2014 page 7..*

“The country's main economic drivers have been based on non-sustainable development activities which are not healthy for its future, a national planning adviser says.

One focus of the recently launched responsible sustainable development strategy is to look at development activities which steered the country.”

“We recognise that many of the economic drivers are not sustainable,” he said. “More is heard about the unsustainable developments like mining and petroleum projects but not much on sustainable development projects.”

“The way we are developing our resources is destroying our country, so we should move towards more responsible and sustainable way of developing the country.”

“.. those responsible had not given time to develop the strategic assets that would not pollute or destroy the environment for future benefitssome of the assets were the country's diverse culture, rainforest, biodiversity and tuna which could be taken advantage of over other countries to make money from. However we are not conserving them. We must invest more on the strategic assets to promote sustainable development so when our mining and petroleum resources run out, we can still make money from other means.. Should we wait until the as, oil or gold runs out or should we start now? The smart thing to do is to start working on it now before the resources run out.”

“Many of our leaders who had made decisions on development did not consider sustainable development.

Our Progress Toward Sustainable Development and its Evolution

There have been sporadic documents analysing our progress toward sustainable development and different Government Departments do occasionally refer to sustainable development. But few government documents or statements referred to the National Sustainable Development Strategy (until recently). Occasionally sustainable development is referred to in lieu of social and economic development. DEC documents do refer to 'environmentally sustainable development', “environmental sustainability” and “environmentally sustainable economic growth”(Department of Environment and Conservation, 1996a, 1996b, 2007), and the Department of National Planning does refer to 'integral human development and sustainable livelihoods' (Office of National Planning ,1999). However, even a consultancy report on sustainable development funded by UNDP at that time failed to mention the agreed strategy (McMaster personal communication, 1999). Notably, the Department of Mining does have a sustainability policy as early as 2001(Banks 2001; Filer 2002). Yet the 2005 Medium Term Development Strategy 2005–2010 (MTDS) scantily or only indirectly referred to sustainability or sustainable development (Department of National Planning and Rural Development 2004). The last MTDS 2011-2015 (Department of National Planning and Monitoring, 2010) on pages 103-107 cover environment (promoting a sustainable environment) and

on pages 108-110 cover Climate Change (adapt to domestic impacts of climate change and to contribute to global efforts to abate greenhouse gas emission); that is 8 pages out of 166 pages cover these important dimensions; economic aspects cover a large part of the document and social only a small number as well. It all is based on the old paradigm of brown development.

Quite often it has been hoped that the National Sustainable Development Strategy would be resurrected. However many important reviews of PNG's progress have been published over the years, some being quite critical of that progress. In preparation for the ten-year review of Agenda 21(Rio + 10), the United Nations (UNDP) in Papua New Guinea advertised the position of a project coordinator (Papua New Guinea *Post-Courier* 25 January 2002) to manage a secretariat for Papua New Guinea's preparation for the World Summit on Sustainable Development ('Rio + 10'), to act as the secretary for the Papua New Guinea national steering committee and to prepare the national assessment report. Such a national review was required to document Papua New Guinea's progress in implementing Agenda 21. The report was prepared by a team from UPNG (University of Papua New Guinea 2002), but it was never accepted, nor presented by the government at Johannesburg, due to its critical nature. The Government did attend the conference, in Johannesburg. However the report has been posted on the internet and published by UPNG (Mowbray, 2003). Papua New Guinea did submit its own report in 2004 to the Barbados Programme of Action for the Sustainable Development of Small Island Developing Countries.(Government of Papua New Guinea, 2004). In early 2005 the Government of Papua New Guinea advertised for a position of coordinator for Goal 7 of the Millennium Development Goals (on environmental sustainability). In 2006 Dr Albert Nita of ESG compiled the PNG National Assessment Report for the United National Department of Economic and Social Affairs, Commission for Sustainable Development in New York of that year. The PNG National Assessment Report on the Implementation of the Barbados Programme of Action (BPoA) for the Sustainable Development of Small Island States (SIDS) was published in 2006 on the SPREP website at www.sidsnetpacific.org for the meeting in Mauritius. In 2012 the University of Papua New Guinea again reviewed our progress since Rio (Rio + 20). Again due to its critical nature it was not accepted by the PNG Government (it is available electronically, John Duguman, personnel communication). The Government did attend the conference, also in Rio. However no PNG report is listed on the web page for National Reports, although Solomon Islands is (see www.sustainabledevelopment.un.org/rio20nationalreports.html).

However there have been some positive steps along the way with important changes introduced and key documents being published. Two key happenings are given as follows. In response to climate change issues, the PNG Government established in early 2000's an Office of Climate Change and Sustainable Development (before that it was a section in DEC) and since have taken on board a number of important issues (including REDD and low carbon projects / activities) and tasked with responsibility to ensure that PNG follows a climate change compatible growth strategy while mitigating greenhouse gas emissions and reducing vulnerability to climate change related risk. See www.occd.gov.pg.

Vision 2050 and National Strategy of Responsible Sustainable Development.

The 'denial' of the PNG national sustainable development strategy is no more. Minister Charles Abel has been very proactive in promoting a new national strategy for responsible sustainable development since 2013. The problems and government actions inconsistent with a sustainable development strategy are recognised clearly by Minister Abel and his staff. They suggest a 'new PNG way' or 'development revolution' and commitment to the new paradigm of green development. This is spelt out in the documents produced by Charles Abel (2014a,b) and in the new national strategy for responsible sustainable development, called the "strategy" (Department of Planning and Monitoring, 2014a,b). They propose their National Strategy of Responsible Sustainable Development. This is discussed in detail in Mowbray 2015c. Here he describes the new

paradigm proposed by Minister Charles Abel and his department for PNG. Here both Vision 2050 (National Strategic Task Force, 2009) and that the “Strategy” proposed by Charles Abel's and the Department of National Planning and Monitoring - the proposed new national strategy for responsible sustainable development, based on the new paradigm of green development, are reviewed and evaluated against ESD and other criteria.

Conclusion

PNG has sustainable development enshrined within its Constitution. The first national strategy for sustainable development was adopted after the Rio conference and following the 1993 Waigani Seminar. Unfortunately PNG basically forgot about this strategy with a number of exceptions. Our Government has done many things inconsistent with sustainable development over the last 20 years, However a new “Responsible Sustainable Development Strategy’ has been championed by Mr Charles Abel and the Department of Planning and Monitoring in 2014. Minister Charles Abel has moved well out of the comfort zone of conventional development theory and for politicians. He has initiated and driven PNG's national strategy for responsible sustainable development through 2014 to 2016, called StaRS.

StaRS provides a totally new paradigm for development in PNG. It is based on the principles of ESD or responsible sustainable development and strategic planning. The shift is to a new road map built on strong sustainable development principles, sustainable livelihoods and green growth and the change to a green economy in Papua New Guinea.

The author in this paper , as does Charles Abel, stresses the need to change both our mindset and world views and our current economic system, reject denial and too-muchness and to transform PNG into a green economy. This is the 'Development Revolution' that our National Strategy for Responsible Sustainable Development requires and we can do it the "PNG way".

We recognise that we are both part of a global community and also part of the community of life. We have responsibilities to all future generations of both human and non-human life. What we need is a compatible economic , social and ecological system where all parts interlink and are sustainable with good governance and personal sustainability by us all. We need an economic system based on strong sustainability, green economic principles and those of ecological economics, green accounting, strategic planning and political economy. One where we put a full value on environmental variables, social justice and ecological justice. Externalities are all internalised. Addiction to growth is ‘no-more’. Discount rates are realistic. Economic instruments support government regulations and community attitudes. We aim for the integration of ecological , social, environmental, institutional and personal sustainability. We reject denial and easy solutions. We aim toward peace and a non-violent social and participatory democracy. We reject wealth and “too-muchness” as an objective but aim for “enoughness” . We aim for an ecological footprint that is sustainable .

And we can do it the PNG way. “StaRS’ is our strategy and a revised Vision 2050 is our aspirational statement.

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ADDENDUM:

History of Environmental Science at UPNG and the Evolution of the Bachelor of Sustainable Development Programme

Environmental Science is not value-free; it is value-laden and has a goal that is to help foster the transition to ecologically sustainable development, a sustainable future, sustainable living

This small addendum gives the history of the Environmental Science programme at UPNG which started in 1982. It then outlines briefly the evolution of the Bachelor of Sustainable Development programme which commenced in 2015, funded by the Ministry of National Planning and Monitoring.

The history of ESG

First let us turn to how Environmental Science (ES) has evolved at the University of Papua New Guinea?

The Environmental Science (now the Environmental Science and Geography (ESG)) program at UPNG was initially proposed principally by Biology staff Dr John Pernetta and Prof Lance Hill. It commenced in 1982 with one staff member (Dr Marcus Chambers) who co-ordinated a cross-disciplinary program of five courses available to students in the then Arts and Science faculties. These were 2nd year *Earth's Biotic Environment*; 3rd year *Resources A* and *Resources B*; and 4th year *Environmental Management A* and *Environmental Management B*; of these last two, one had a focus on conservation and the other on environmental planning and protection. In the mid 1980s Associate Professor Philip Hughes replaced Dr Chambers but the courses remained basically the same with the addition of *Environmental Science Special Topics* (project based course). Staff from other disciplines contributed greatly. These included Dr Peter Eaton (Law), Dr Betsy King (Geography), Mr Tony Lawrence (Physics), Dr M. Ghani (Geology), Dr David Mowbray, Dr John Pernetta and Prof Lance Hill (Biology). In 1992 Dr David Mowbray who had assisted by teaching the *Earth's Biotic Environment* course transferred from Biology to Environmental Science as the co-ordinator and associate professor. In the early 1990s Environmental Science received support from the International Development Program (IDP) of the Australian Vice-Chancellors Committee. IDP provided extra visiting staff. From about 1992-1994 postgraduate students from Australia, principally Monash University assisted by teaching in segments of the courses. These included Eric Bottomley, Darren Gladman, Bill Grant, Doug Holmes, Ron Martin, Errol Stock (Griffith University), Rob Walker, Barry Windridge and Michael Cookson. IDP also provided a substantive collection of ES texts to the Michael Somare Library. In 1997 both Dr Elspeth Young and Dr Colin Hunt from ANU Environment and Development Program in the National Centre for Development Studies contributed in a staff exchange with Associate Professor David Mowbray, who taught at ANU in the Environment and Development programme there. These Post Graduate students from Monash were selected by Dr Frank Fisher who always chose the right person, each contributing enormously to the programme!! About this time Albert Nita joined the program. By then new 4th year courses commenced including *Integrated Environmental Assessment (IEA)*, *Chemical Risk Assessment and Management (CRAM)*, *Environmental Pollution and Protection (EPP)*, *Nature Conservation Strategies (NCS)*, *Environmental Science Special Topic* in addition to the ES Special Project. These subjects replaced the the two previous Environmental Management Courses. Professor Lance Hill taught a course on *PNG Biodiversity* in Biology. In 1995 John Duguman joined the program with Albert Nita going off for further study to New Zealand. In 2004 the

University merged Environmental Science and Geography (which included a subdivision on Demography) into the new discipline of Environmental Science and Geography. Prof Chalapan Kaluwin joined the program in 2005 as its first professor. GIS was transferred from Biology in 2006.

By 2007 it was a large department consisting of Environmental Science, Geography, Demography and GIS with 13 staff teaching 39 courses.

The webpage and description of program

By 2007 ESG had an excellent webpage on the UPNG server (www.upng.ac.pg) constructed by Patrick Koliwan. It presented the ESG prospectus and a clear mission statement and objectives, as shown in Appendix Box 1. It outlined the scope of the teaching programme of Environmental Science and Geography with a listing of all staff and courses offered.

Appendix Box 1 outlines the introduction to both the prospectus and the ESG site. Appendix Box 2 states the mission status and objectives. For both the many great / beautiful photos have been excluded. It is expected that these webpages will be modified and again linked to either the new UPNG or SNPS websites in the coming months. Again see www.upng.ac.pg go to Environmental Science and Geography see ESG link.

Addendum Box 1 Homepage for Environmental Science and Geography, 2007.

(from www.upng.ac.pg Environmental Science and Geography webpage ESG link, as per web page 2007-2014. A similar but updated introduction to ESG will appear in late 2016 when new UPNG website will be available on the internet)

Welcome to the **Environmental Science and Geography** website. Read about our new and exciting program here at UPNG.

Papua New Guinea is a country of enormous biological and cultural diversity and wealth. Every where in PNG our world is changing; our environment is changing, the way we live is changing. Moreover our environment is threatened by current patterns of development, consumption, unsustainable use of our resources, environmental pollution, poverty, population growth and policies of government. We need to learn to sustainably manage our renewable resources such as biodiversity, forests, land, water, coastal and marine ecosystems as well as manage our mineral, petroleum and other energy resources to ensure a better future for all.

Environmental Science and Geography are holistic sciences that use and integrate knowledge from the natural sciences (ecology, biology, chemistry, earth sciences), applied sciences (engineering, conservation biology) and from the social sciences (demography, economics, politics, ethics) in a dynamic blend that sometimes questions the way we view and act in the world around us. In , the pace and type of socio-economic development require decision-makers to understand a wide range of often conflicting issues. Environmental Science and Geography provides the knowledge, skills and training that can make its students better equipped and informed citizens, more able to understand the important issues facing our communities and our country and, be better prepared to contribute to their solution. We offer an exciting range of course that provide both a strong introductory and theoretical base, then we look at the problems and address the solutions. We also provide courses teaching specific management tools eg GIS, demographic methods, EIA, risk assessment and others. The Environmental Science and Geography programmes offered at the University of Papua New Guinea are designed to enable students to relate the application of their specialist knowledge and skills in their discipline to real problems that exist in the PNG (and South Pacific) environment at the moment. The programmes include field work and visits to examples of the various development projects throughout the country to study environmental and conservation problems first hand. There are numerous employment opportunities for graduates from our programme in government and private sectors and with non-government organisations.

Check out the links in the navigation menu to find out more about Environmental Science and Geography at The South Pacific's Premier University!!

Click the following links to download or view [Powerpoint Presentation](#) and Brochure_ for the course materials, staff, other relevant information for the ESG strand.

Addendum Box 2 ESG Mission and Objectives in 2007

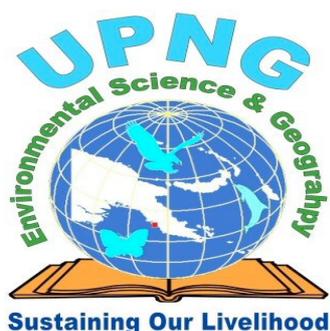
(from www.upng.ac.pg Environmental Science and Geography webpage ESG link, as per web page 2007-2014; the new updated mission and objectives will appear on the new 2016 ESG site when the new UPNG or SNPS website will become available on the internet)

The mission of our programme is to contribute knowledge and training in the area of Environmental Science and Geography in Papua New Guinea and the island countries of the South Pacific; and to produce graduates with a holistic world view, with strong ethical beliefs and standards, committed to trying to ensure a sustainable future for Papua New Guinea.

The mission is effected through the following aims:

- To train undergraduate and postgraduate students to be effective environmental scientists, geographers and demographers, both generalists and specialists, working in government, industry, the university, with NGOs and the community.
- To provide holistic training and awareness programs in environmental science/studies, geography and demography for specialists in other disciplines, etc.
- To promote amongst decision makers and the community at large an ecological ethic, the recognition of the need for environmentally sustainable development, and the need for ecologically sound principles in development planning.
- To mainstream environment into development planning by emphasising sustainability in the ecological, economic, social and institutional aspects of developing policies, plans, programmes and projects.
- To train government officers and other specialists in the private sector, NGO's and community workers with short courses - for example in conservation in ecology, environmental education, environmental law, resource and environment management and planning, chemical management and environmental impact assessment and
- both physical and population planning. .
- To assist in strengthening environmental teaching awareness in primary and secondary schools, and in the non formal sector.
- To teach important tools used in resource and environmental management to enhance our ability to plan to manage better our natural resources, eg geographic information systems (GIS) and remote sensing, demographics methods, EIA, risk assessment, and many others.
- To provide expertise and advice through consultation and communication to the government of PNG (eg Department of Environment and Conservation), the Secretariat of the Pacific Regional Environmental Programme (SPREP) and other governments of the South Pacific, and UN agencies on environmental and development problems

ESG has its own logo, as below



It also had a clearly stated graduate profile and outline of career options for students. It offered six strands and remained interdisciplinary but its own staff taught all the programme though assisted by a few staff from Biology (mainly Professor Lance Hill, Tom Pringle and Dr Jane Mogina), and from Physics, Chemistry and Geology.

Most students came from the School of Humanities and Social Science (SHSS) and the School of Natural and Physical Sciences (SNPS) but a few students from School of Business Administration (SBA) (economics) now School of Business and Public Policy (SBPP) did selected courses, as did a few from Creative Arts and Journalism and in this year from the Tourism programme.

Since 2014 **ESG “mainstream”** has had six core course combinations that covered a range of themes from science to management; a flowing through of basics (first year), to issues (second year), to problems (third year) and to solutions ((fourth year) as per:

Stream No	Stream possibilities
1	Environmental Science (as a co-major) with Biology, Chemistry, Physics, GIS, Earth Sciences,
2	Economics, Law, Journalism, Community Health
3	Environmental Science and Geography
4	Geography (Human and Physical)
5	Resource & Environmental Management Tools and Applications-
6	Geographic Information System/Remote Sensing
7	Population, Environment and Development (Population Studies as a co-major)

We also have a number of Honours, PGDS and masters students and one PhD student.

In 2017 it is hoped to introduce a Post Graduate degree in Physical Planning.

ESG Course Programmes

ESG has been very active through 2014 to 2016. This is shown by an overview of its activities. These are shown in Appendix Box 3:

Appendix BOX 3

Programmes under Discipline of Environmental Science and Geography

TEACHING

ESG mainstream

1. Environmental Science
2. Geography
3. Geographic Information Systems and Remote Sensing
4. Demography and Population Studies

Others

- ❏ Bachelor Sustainable Development (BSD)
 - ❏ Undergrad Sustainable Development
 - ❏ Post graduate Sustainable Development
 - ❏ Continuing BSc BSD
- ❏ LLB Bachelor of Sustainability Laws (LLB BSL) commencing in 2017)
- ❏ Diploma in Comprehensive Hazard and Risk Management (Dip-CHARM)
- ❏ Bachelor of Comprehensive Hazard and Risk Management (B-CHARM) commencing in 2017)
- ❏ Diploma in Physical Planning (DipPP commencing when funding available)
- ❏ Post Graduate Diploma in Conservation management and Development (with Biology lead Discipline) (PGDipCM&D)

RESEARCH & CONSULTANCY & OUTREACH

Centre for Climate Change and Sustainable Development

Incorporating projects on energy, forest management, climate change, REDD, marine resources; includes the Pacific Pesticide Project.

Assisting Government departments and authorities: National Planning and Monitoring, Provincial and Local Level Government, Climate Change and Development Authority, Conservation and Environmental Protection Authority

Today ESG consists of 24 academic staff teaching 46 undergraduate courses to be across three strands: Environmental Science, Geography and Population and Demography. Environmental Science and Geography can be studied by students as a major or co-major. Our “ESG mainstream” programme is given in Appendix Box 3 below:

Appendix Box 3

2016 ESG PROGRAM OF COURSES

ESG MAINSTREAM COURSES

Course offered in Discipline of Environmental Sciences and Geography in 2016

See separate handbook for courses in the BSD and Dip CHARM programmes

	ESG		2016	
Year of Study	Semester One	Staff	Semester Two	Staff
School Course	1.22310 Global Environmental Change	CS,	WP responsible for all External FY students doing FG & FES.	
Year 1 for SNPS, SHSS & SBPP but can enter in Year 2	1.12309 Foundation Geography (internal and external) <i>note replaces 1.12310 Introduction to Geography</i>	GS, CS, LT, NM,	1.12301 Fundamentals of Environmental Science (internal and external) <i>note replaces 1.22301 Introduction to Environmental Science</i>	WP, DM, LT + 4 T
Year 2	1.22332 Rural Systems and Food Security 1.22351 Integrated Terrestrial and Coastal Processes 1.22380 Introduction to Demography and Population Studies	NM FA AF	1.22318 Geographical Techniques 1.22353 Soils and Land Use 1.22354 Climatology 1.22361 Pacific Peoples and Environment 1.22383 Demographic Methods and Analysis	NM,LT JI JI CS AF
	1.32306 Introduction to GIS and RS 1.32304 ESG Work Experience [for	RK JD,	1.32305 Remote Sensing Technique and Application	RK

Year 3	Lahara enroll in Preregistration at end of semester 2]	CK	1.32332 Challenges to Rural Environments	CS,AM
	1.32331 Urban Environmental Crises	AM	1.32355 Island Biogeography	GS
	1.32354 Fluvial and Coastal Geomorphology	JJ	1.32356 Integrated Catchment, Coastal and Island Management	FA,PL
	1.32371 Resource Management & Environmental Sustainability	GG	1.32375 Biodiversity Conservation, Policy and Law	SO, JG,CK,
	1.32373 Economic Geography	NM	1.32376 Environmental Governance	GG
	1.32374 Climate Law	CK, SO	1.32384 Demographic Research and Methodology	AF
			1.32385 MDGs & Human Development	AF
	1.32380 Computer Applications for Demography and Population Analysis	AF		
Year 4	1.42306 Research Techniques & Skills	DM, OB,JD	1.42309 Research Project	ALL
	1.42307 Selected Topics	ALL	1.42310 Project in GIS and RS	RK
	1.42308 Advanced GIS & RS	RK	1.42332 Rural Regional and Development Planning	AM
	1.42331 Urban Planning and Management	AM	1.42351 Oceans and Coastal Resources Management	
	1.42355 Catchment Hydrology	JJ	1.42354 Climate Change Variability, Impacts and Adaptation Strategies	PL, CK
	1.42373 Comprehensive Hazards and Risk Management	CK, JD,PS	1.42356 Spatial Analysis for Natural Resource Management	CK, JA GS,MK RK
	1.42379 Biodiversity Conservation Strategies	JG	1.42383 Population and Development	AF
	1.42377 Environmental Impact Assessment	JD	1.42378 Protected Area Management	JG,JD, RMcK
	1.42384 Migration in the 21 st Century	AF	1.42376 Pollution Science	DM, RT
			1.42391 Topics in ESG	ALL

ESG students may choose to do:

Year	Course available to ESG students	Pre-requisite
3 or 4	Green and Ecological Economics PS & DM	Foundation Economics
2 or 3 or 4	Environmental Science and Sustainability: Principles and Policies DM & ESG/BSD staff	Introduction to Environmental Science Fundamentals of Environmental Science

Staff teaching:

CK – Chalapan Kaluwin, GS – Graham Sem, FA – Freddie Alei, CS – Clementina Supru, LT – Lorraine Taram, NM – Norlie Miskaram, WP – Walhos Palisa, JJ – Joseph Irai, RK – Regina Kiele, JD – John Duguman, JG – John Genolagani, AM – Angela Mageto, PL – Pochon Lili, GG-Gae Gowae, DM – David Mowbray. JA - Jason Alonk, PS – Peter Samuel, AF - Alfred Faiteli, OB – Olive Baloi. SO – Stephen Oli. SS – Samuel Siwi. R.McK – Richard McKellar (visitor).
And for some courses = visitor(s) and guest lecturers.

Other Staff- MK-Moyep Kilepak (Physics), RT -Robin Totome (Biology) and tutors.

Staff: absent doing PhDs overseas or here are:

GN – Georgina Numbasa (RMIT, Melbourne); and TS – Terence Simbiwen (James Cook Uni, NQ)

In 2015 a new Degree in Sustainable Development commenced (Appendix Box 4) from within SNPS with help from other schools. There are 13 extra courses in BSD and one in CRAM.

APPENDIX BOX 4

Core Courses in the Bachelor of Sustainable Development Programme

Following are the Core Courses we offer in Degree in Sustainable Development in 2016 based on the entry through SNPS (Science) as an undergraduate programme . Post Graduates and continuing students also do these courses. All are compulsory. Students can choose additional optional courses)

Year of Study	Semester 1	Semester 2
1	1.12309 Foundation Geography (FG)	1.12301 Fundamentals of Environmental Science (FES)
2	1.20401 Introduction to Sustainable Development (ISD)	1.20402 Planning for Sustainable Development (PSD)
	1.20411 Sustainable Project Applications and Management (SPAM)	1.20403 Sustainable Development Law (SDL)
	3.10301 Foundation Economics (FE)	3.13403 Introduction to Development Studies (IDS)
	1.32371 Resource Management and Environmental Sustainability (RMES)	1.20412 Environmental Science & Sustainability Principles and Policies (ESSPP)
3	1.30409 Green and Ecological Economics (GREEN)	1.30405 Sustainable Built Environment (SBE)
	1.30413 Resource & Environment Negotiations & Conflict Resolution (RENCOR)	1.30404 Service Improvement Principles and Techniques (SIPT)
4	1.40407 Sustainable Development Project/ Field Experience (12 pts)	1.40408 Special Topics in Sustainable Development Applications (6pts)
		1.40406 Principles of Green Environmental Engineering and Cleaner Production
		1.40410 Sustainability Solutions
	Note that we run a Dip CHARM programme with two extra courses and proposed new programme for a B CHARM	1.22333 Introduction to Disaster Risk Management to be determined proposed are (but not yet approved): 1.210xx (Types of and) Geography of Hazards 1.310xx Managing Risk and Resilience in Disaster Management xxxxxxx Mathematics of Modeling 1.41001 CHARM Project Research 1.41002 Hazards and Risk Strategies 1.41003 Service Improvement for Disaster Management]

ESG is prepared to take on challenges, is innovative and prepared to move out of its academic comfort zone. ESG and SNPS should be proud to be involved in these initiatives. Most of our BSD students come from Science. It is sad that neither SBPP nor SHSS were prepared to be bold enough

to encourage their students to also do the Bachelor in Sustainable Development, although they have welcomed students from the BSD programme into some of their courses.

Some examples of what we teach are given in Appendix Box 5 and Box 6 below:

Appendix Box 5

Examples of courses in the BSD programme

Example of course 1 = 1.20401 Introduction to Sustainable Development

The aims of this course are

- for you to understand what are sustainable development and sustainability;
- to know the history of sustainable development;
- to recognize that sustainable development is a multidisciplinary subject in which we study the ‘resources’, ‘environment’ and ‘sustainability’ at the village, national and international levels;
- to study the different perspectives: ecological, social, economic, cultural, spiritual, political, institutional and personal;
- to relate local, national and global environmental issues in the context of human development and our relationship with our environment; maintaining environmental quality and a sustaining the environment and improving social well-being and sustainable livelihoods;
- to recognize ‘the big elephants’ and the main drivers of unsustainability’;
- to understand key concepts eg strong vs weak sustainability, carrying capacity, ecosystem services, ecological footprint, Earth capital, IPAT, and planetary boundaries;
- to gain familiarity with PNG’s national strategy for responsible sustainable development , StaRS.

Like environmental science the central tenet is “sustainability”.

The course comprises of 15 modules:

(1)Setting the Scene-development and what it means and different theories; (2) sustainable development (3) history of sustainable development; (4) Solar capital, Earth capital and sustainability; (5) human populations and the environment; (6) global environmental issues;(7) the 8 MDGs and 17 SDGs and the Earth Charter; (8)Ecological footprint; (9)Carrying capacity; (10) Ecosystem services and valuing nature; (11)Think globally and act locally; personal sustainability; (12) The doomed civilization-Easter Island; (13) The sustainable country – Costa Rica; (14) World views, ethics and values; (15) Introduction to StaRS and sustainability principles for sustainability solutions.

Example of course 2: 1.20402 Planning for Sustainable Development (PSD)

The aims of the course are:

- for you to critically examine and learn the key concepts and principles for both planning and implementing sustainable development and living;
- to adopt a more ecocentric world view and so live a sustainable lifestyle and encourage others to do likewise;
- to learn how we might aspire to an expanded Vision 2050; PNG can be smart, fair, wise, healthy and happy nation whilst maintaining cultural diversity, spirituality with a sustaining environment and ensuring empowerment to all especially women and ensuring enoughness and sustainable livelihoods for all; and respecting the community of life;
- to gain an insight into a variety of sustainable development strategies;
- to contrast 4 societies: Easter Island (doomed), Costa Rica (sustainable), PNG (developing), Australia (over-developed) in terms of a sustainable future;
- to assist you to be both motivated and skilled in the tools to implement PNG’s National Strategy for Responsible Sustainable Development, or StaRS and ensure that all PNGians may live sustainably whilst maintaining a sustaining

environment.

The course has 15 modules:: (1)Planning sustainable development; (2)PNG planning process; (3)Goals of sustainable development; (4)-(6) Constraints on sustainable development= over population, over consumption, globalization, world view, conventional thinking, addiction to growth, current economic system = Capitalism, denial, too- muchness, sustainability illiteracy; (7)-(10) Solutions to sustainable development = ecological sustainability, effective leadership, good governance, people participation, appropriate and cleaner and greener technologies and energy and water efficiencies, sustainable cities and villages; sustainable livelihoods (11)personal sustainability / Individual action, education for sustainability literacy (12)The new science of Sustainability Science, (13)Introduction to green and ecological economics and the steady state economy; (14) Implementing StaRS, (15) Where to now – making PNG a sustainable country and ensuring sustainable living for all PNGians, and ensuring a sustaining environment and the rights of the unheard (all life in PNG).

Example of course 3 = 1.20411 Sustainable Project Applications and Management (SPAM)

The aims of the course are to

- introduce students to an alternative to the traditional project cycle or project management cycle, being sustainable project management, and introducing Gilbert Silvius;
- introduce students to the logical framework or logframe tool to plan, evaluate and monitor projects;

Units in the course cover ((1) Introducing sustainable project management vs tradition project management and cycle; (2) introducing the logframe methodology; 3) linking environmental management to and incorporating sustainability considerations into project management; (4) changing the mindset and world view of project managers and both government and corporate planners so use sustainability principles (5)changing corporate or company and consumer behaviour ; (5) introducing environmental best practice and risk assessment into project management; (6) public sustainability / environmental / social reporting and public participation; (7) sustainability principles and ethics in project management – a new way of doing things- eg Millers six principles, precautionary and polluter pays, enoughness, and many more (8) taking responsibility for projects and project management to ensure a sustainable future in PNG.

Example of course 4: 1.30409 Green and Ecological Economics (GREEN)

The aims of this course are to

- introduce students to an economics that accounts for both the ecological realities and social concerns.
- provide PNG with an economics for the new paradigm of green development in PNG.

Modules for the course are (1) why we need a new economics course at UPNG, (2) false assumptions of neo-classical economics in particular weak sustainability, world view, anthropocentrism, planetary management, lacking ethical and equity considerations, addiction to growth and unlimited resources (both ecological absurdities), incorrect discounting, zero value on the environment, not valuing nature and ecosystem services; (3) differences between environmental and ecological economics;(4) convergence of ecology and economics and birth of both ecological economics and green economics and their differences; introducing Herman Daly and Rob Costanza; (5) the steady state economy (6) contrasting strong vs weak sustainability; contrasting green economics and green growth (7) alternative measures of well-being and sustainability – problems with GNP and growth; (8) Can we put monetary values on biodiversity and ecosystem services – film: *Banking Nature* (9)economic valuation of natural assets / ecosystem services and total value of PNG ecosystems; (10) introduction to environmental accounting; (11) economic instruments for environmental management and for sustainability; (12) introducing political economy for PNG (13) strategic planning; (14) Capitalism vs Nature – introducing Naomi Klein and her film – “This Changes Everything - Capitalism vs The Climate (and Everything!) ; and (15) The new world view and a new economics for sustainability- plotting for and implementing the green economy in PNG and our new paradigm. – incorporating good economics into the sustainability revolution.

Example of course 5 = 1,30404 Service Improvement Principles and Techniques (SIPT)

The aims of this course is to

- introduce students to a better knowledge base and to the skills and understanding of the principles of service delivery improvement and techniques.
- improve service delivery within the public and private sector in PNG and educating the public.

The course covers (1) How can we achieve improved human development in PNG and fulfill all 17 sustainable development goals (SDGs) - in part -- by improved service delivery! (2) key principles of service improvement – and concepts and techniques in service delivery (3) evaluate and critically review service delivery efficiencies at present in PNG taking examples eg health and education services, and for natural disaster management with famine, drought, floods, landslides and volcanic eruptions etc; (4) introduce students to the PNG Government Service Improvement Programme (SIP) and strategies for service delivery in PNG; (5) learning practical tools and techniques to use in improving efficiency and effectiveness of service delivery and efficiency and effectiveness of organisations, using these case studies in PNG. (6) Students will learn the DIAT methodology. (7) integrating the role of government, the private sector and the community at improving service delivery; (8) educating the community on service improvement principles and techniques (9) Students will choose a case study in a service delivery problem and investigate its causes and effects, advance solutions for it, test them and determine sustainability solutions using the DIAT techniques. (10) Prescription developing a checklist of service improvement techniques applicable in PNG .

APPENDIX BOX 6

Example of Activities from 1.20401 Introduction to Sustainable Development , of a Class Workshop Activity

The objective of this exercise is to relate all that you do in this course to those big elephants and drivers of unsustainability; to draw the various models of sustainability, to distinguish between strong and weak sustainability and to recognize both core principles and important ecological concepts.

The big elephants: rapid population growth, overconsumption, pollution, addiction to growth, poverty and inequity, lack of human development, poor governance, some religious & cultural constraints... what else

The drivers include:

But be sure to understand what we mean by “sustainability”

importance of strong sustainability v weak sustainability

core principles are:

ecological sustainability, social equity, economic justice , participatory / grassroots democracy, transparent /good governance, ecological wisdom, personal sustainability = “think globally and act locally”, ecological justice (for all life), peace, disarmament and non-violence

- anthropocentric and planetary management world views (as to ecocentric and Earth Wisdom world view)
- the economic system of Capitalism based on growth and Earth exploitation with no limits!
- Denial in its many forms
- Refusal to accept “enoughness” = “too-muchness” = greed
- “Sustainability illiteracy”

REVISED VISION 2050 (extra icons)

smart, fair, happy, wise, healthy, maintain spirituality, maintain cultural diversity, maintain a sustaining environment, good

governance, empowerment (including women), equality, 'enoughness' or well-being.

Models of unsustainability

Models of ecologically / responsible sustainable development = circles unlinked: economic, social, ecological, governance, personal, political, cultural .. **Key ESD model** – 5 dimensions **Able's in StaRS**– 3 dimensions and overlap(s) **Mulligan's model** of personal sustainability **ecological concepts:** IPAT, Carrying capacity, **Ecological economics** model of 3 concentric circles: ecological, ecological footprint, biological and ecological social and economic boundaries, ecosystem services, value of nature,

Major sources:

Walhos Palisa Concepts in SD & Living Mowbray's K10 and K20 flash drives 'Miller 17th edition other SD texts on K20 flash drive

Important documents:

PNG's National Goals and Directive Principles , 1992 Agenda 21, 2000 Earth Charter, MDGs and SDGs; StaRS

Has 15 activities

Example of: **Activity 2:** Draw diagram to represent the four models of sustainability: ESD, Able/StaRS, social ecology and that of ecological economics & also corresponding unsustainability models.

Example is Activity 1:

Discuss the 'core principles of ESD /RSD and the extended icons for a new Vision 2015

Example of **Activity 3:** Do you think that particularly in Western countries that a green economy requires a strategy of degrowth, if we in developing countries can attain a acceptable level of “enoughness”?

What other big elephants are there? Look at drivers. Why add “wanting too-muchness = wealth!”?

Why does Naomi Klein say that “ecology is at war with conventional economics”?

In our BSD programme we included a new course on Green and Ecological Economics. An outline is given in Appendix Box 4,

The mainstream or traditional and conventional economics is recognised by environmental scientists as one of the major drivers of environmental unsustainability and the many global big issues faced by both people and Nature today..It accepts weak sustainability, not strong sustainability. Economists (like most politicians) are addicted to growth!! Mainstream economics makes assumptions that any introductory ecology student knows are absurd and incorrect. Many economists externalise factors that ought be internalised and accounted for. Often little or no value is given to the very ecosystem services and biodiversity that sustain our environment. Economists use discount rates that cause more rapid environmental deterioration than ones that might eg conserve species or habitats. We chose to introduce an economics course consistent with the objectives of strong sustainability and sustainable development. We believe that this new approach to economic thinking and planning is part of the base for introducing responsible sustainable development or green development. We named it “Green and Ecological Economics. Its focus was principally on both green economics and ecological economics. We choose in particular two texts which were outstanding texts in both fields, but used a variety of others. These texts were “*An Introduction to the Green Economy - Science, Systems and Sustainability*”, by Adrian C. Newton and Elena Cantarello published in 2014 by Earthscan,; and “*An Introduction to Ecological Economics*” by Robert Costanza and others, second edition published in 2015 by CRC Press. Mr Peter Samuel of ESG , who has a Masters in Ecological Economics, draws a lot also from the Odums (in particular Howard and Elizabeth) who collectively have contributed substantially to this

new discipline.. See list of books in Appendix Box 9.

I also add here examples of exercises and both seminar and exam questions for our GREEN students. See Appendix Box bb

APPENDIX BOX 7

Example of Exercises and Tutorial and Exam Questions to students doing 1.30409 GREENHOUSE

Exercise example (by Prof David Mowbray):

Students calculated the total value of PNG Ecosystems. They did this using data provided by Robert Costanza in one of his publications. His publication provided the value in US dollars per hectare of all ecosystem services in different ecosystems. We made our assumptions, then we calculated the total area of the various PNG ecosystems, terrestrial and marine and freshwater. This information was provide by ESG staff Regina Kiele a GIS expert. From this we determined that the total value of ecosystem services far far exceeded PNG's GNP of about 18billion kina. In fact it exceeded 100 billion kina. Yet economist put zero value on most of these ecosystem services.

Peter Samuel gave students various qualitative and quantitative exercises including flows in a high waste economy vs a low waste economy, what a steady state economy would be, contrasting opportunity cost and real cost, why ecological economists dislike 'willingness to pay' as not reflecting the true value of a resource.

Students saw two very controversial films and had to critically review both. One called "*Banking Nature*" was about putting monetary values on Nature, something questioned by many. But also it was noted that investors saw an opportunity here to make a profit and disregarded the conservation value of putting monetary value on life to protect it.

The second film was "*This changes everything. Capitalism vs The Climate*" based on the book by the same name by Naomi Klein. To quote reviewer Chris Bentley of the Chicago Tribune " If global warming is a world wide wake up call, we're all pretty heavy sleepers .. We haven't made significant progress, Klein argues, because we have been expecting solutions from the very institutions that created the problems in the first place. Klein's sharp analysis makes a compelling case that a mass awakening is part of the answer. And from Camilla Cavendish of the London Sunday Times who says " The book has an uplifting message, that humans have changed before and can change again . It poses a gutsy challenge to those who are vaguely hoping that the whole issue will go away. Or that some new technology will save us.

For Klein says:

" The really inconvenient truth is that it is not (only) about carbon – its about capitalism. The convenient truth is that we seize this existential crisis to transform our failed economic system and build something radically better."

"We must face up to and take on the challenge , the most profound threat humanity has ever faced: the war our present economic model of capitalism is waging against life on Earth.

Questions

Some questions which formed the basis of discussion and seminars, and some appeared as exam questions, included:

Question 1

What are some of the false assumptions environmental scientists say that traditional economists make the students studying ecology recognise as absurd and incorrect?

Question 2

Why did economics and ecology converge into the new discipline of "ecological economics." Describe briefly the evolution of ecological economics. In particular state the roles of Herman Daly and Robert Costanza, and from what backgrounds did each come from.

Question 3

What is the green economy paradigm ? Contrast between green growth, green economics, steady state economy and conventional economics.

Question 4

To achieve sustainability, biological limitations and ecological constraints and planetary boundaries must be recognised. Explain how we can achieve this, State three planetary boundaries ecologists believed we have crossed.

Question 5

Contrast ecological economics with environmental economics.

Question 6

Explain why ecological economists are critical of the methods by which economists estimate the present and future values of a resource, or ecosystem service and the optimum levels of pollution control and resource use.

Question 7

Explain the two fundamental laws of thermodynamics and why they are important in the study of ecological economics. Explain 'recycle' and 'entropy'.

Question 8

Ecological economics can be defined by its focus on nature, justice and time. Key themes in ecological economics include scale, distribution and allocation. Explain both these.

Question 9

Explain why environmental scientists regard cost-benefit analysis as a crude tool. How would environmental scientists estimate cost and benefits or risks and benefits?

Question 10

How can economists put a value on 'needs' and 'well-being' when considering sustainable development?

Question 11

Can you explain what you would study in studying the "political economy of sustainable development"?

Question 12

The Head of World Vision, Rev Tim Costello said recently

We are in the middle of a paradigm shift occurring across the world. We understand now, better than ever that our well-being as peoples, and our progress as a nation depends upon much more than what economic measures alone can tell us.

Explain what he meant!

Question 13

How do we keep a tab on our progress? Why is GDP alone or growth rates both absurd measures of

“progress” or development? What do they really measure and tell us? What other sorts of measures or indices can we use to measure progress or well-being or sustainability. Name some of the most widely now used. How might we measure the various components that make up the revised Vision 2050 icons in a way that PNGians can both understand and measure themselves.

Question 14

- a. Can we achieve sustainable development under our current develop model of 'modernisation' and our current economic system of Capitalism? Argue your case.
- b. What are the fundamental changes needed to the current economic system to achieve a green economy and one that satisfies both green economics and ecological economic and
- c. Mention some of the obstacles and barriers that would be needed to be overcome.
- d. Would this bring about a sustainable society? Justify your answer/

Question 15

Distinguish between strong and weak sustainability and provide examples of each. Distinguish between the concepts of an empty world and a full world. Provide two reasons why the current PNG economic model supports weak sustainability.

Question 16

PNG has a unique model for sustainable development as compared to the rest of the world. Why does it add institutional sustainability (or good governance) to the more generally accepted model of the triple bottom line of economic sustainability, social sustainability and ecological sustainability. Some add personal sustainability as in the social ecology model. Discuss this contention, Why does PNG advocate four or five pillars instead of 3?

Question 17

Define the concept of the steady state **economy**. Explain how nations can achieve a steady state economy.

Question 18

When politicians and government officials refer to 'sustainable development' or to 'green growth,' which definitions do you think they have in mind.

Question 19

What do ecological economics and political economy have in common? Explain what you must consider in evaluating the “political economy of sustainable development?”

Question 20

Can the green economy and ecological economics deliver both sustainability and sustainable development?

Question 21

DISCUSS THE FOLLOWING:

The basic problems for which we need innovative policies and management instruments include:

- **Unsustainable large and growing human populations that exceed the carrying capacity of the Earth; and whose ecological footprint exceeds the**

Earth's biocapacity;

- **Rapidly increasing inequality within and between nations;**
- **highly entropy-increasing technologies that deplete the Earth of its resources and whose unassimilated wastes poison the air and the water and the land;**
- **Land conversion that destroys habitat, increases soil erosion, and accelerates loss of species diversity..**

(From Rob Costanza et al 2015 An Introduction to Ecological Economics page 3 (modified))

Question 22

Naomi Klein says of global warming:

“ The really inconvenient truth is that it is not (only) about carbon – its about capitalism. The convenient truth is that we seize this existential crisis to transform our failed economic system and build something radically better.”

“We must face up to and take on the challenge , the most profound threat humanity has ever faced: the war our present economic model of capitalism is waging against life on Earth.”

(From Naomi Klein 2014, This Changes Everything Capitalism vs the Climate” (modified)

Do you agree with Naomi Klein that if indeed we are to achieve sustainable development and solve the big problems of today, then we must reject the current economic system that most accept, and move out of the box , accept ecocentric values and an Earth Wisdom World View, and develop a green model based on green economics and ecological economics which together give value to Nature, rejects the idea of continuous growth, recognises planetary boundaries and puts an emphasis on equity and ethics; and recognises that both government and the community decide, not just the laws of demand and supply, and the market.

Question 23

First note the great differences between Environmental Scientists (including ecological economics and green economics) and Neo-liberalism or traditional Economics

Now look at the table which makes comparisons. Do you think that the comparisons are correct. Do you disagree with any?

Go check with your Economics tutors or lecturers. Ask them for their view.

The environmental scientist and the economist “live a world apart”!!!

Environmental Scientists view	Traditional Economics View / Neoclassical economics / Neoliberalism
Ecocentric values	Anthropocentric values
Earth Wisdom World View	Planetary Management World View
Recognition of biological limits, ecological constraints and planetary boundaries	Addiction to Growth

Value ecosystem services and biodiversity - both ethical & monetary	No or little value of biodiversity – if given value then only monetary
Internalise all externalities	Often pollution and health effects are externalities
Method of discounting future – makes appropriate assumptions	Method of discounting the future – with wrong assumptions; often high discount rates cause immediate use and undermine future value
Strong sustainability where Enatural capital ≥ 0 assume an 'empty world' so recycle and conserve.	Weak sustainability where Etotal capital ≥ 0 assume a full world so limited recycling and conservation; tend toward over use
Emphasis on renewable	Presently much use of non-renewables, slow uptake of renewables
Emphasis on best environmental best practice / ethics / codes / standards	Profit is number wan!! Codes and best practice are OK as long as profit not affected.
Emphasis of integrated economic, social and environmental benefits; uses the new paradigm of sustainable development	Emphasis on socioeconomic benefits; the old paradigm
Prefer an integrated triple bottom line approach of an integrated economic, social and ecological assessment	Cost benefit analysis is an important tool
Governance mixture of government regulation, appropriate economic instruments and community involvement / inputs	Minimise government regulation leaving it to market forces
Ethics very important; there is a right and a wrong!	No ethics – supply and demand and markets decide
Both intergenerational and intragenerational (social) equity important	No equity = possible “trickle down effects” (a myth!)
Enoughness adequate	Too muchness is goal / outcome – accumulate wealth at expense of both other people and the environment. Poor get poorer and the rich get richer.
Eventually must move toward a steady state economy . Every one has adequate and environment is sustained.	Continuous growth means wealth and jobs
Progress or well-being or sustainability measures by a variety of indicators, single or aggregate; and include measures of economic, social, environmental , institutional (governance) personal aspects of sustainability.	Progress or increase in well-being measured solely in economic terms, eg GDP or growth
Sustainable development measured both quantitatively and qualitatively eg water quality and happiness.	Sustainable Development reformulated in economic terms as “without diminishing well-being in the future”

Now look at the comparisons in the table.

We also offer now a diploma in Comprehensive Hazard and Risk Management (CHARM) , but from 2017 it will run as a full degree in CHARM. We have also proposed a new Post Graduate Diploma in Physical Planning for PNG. These include offering extra new courses; most with the theme of “sustainability”. In 2017 the Biological Sciences Discipline will offer a Post Graduate Degree and Diploma in Conservation Planning and Management (with *Mama Graun* Conservation Trust Fund). Some ESG staff are also involved. We also provide specialised short courses in urban planning and GIS.

Present students numbers have exploded with in first semester 2016 both the ESG and BSD programmes attracting very many students with up to 100 students (even in our fourth year courses) doing our courses. This second semester we shall have 250 students doing our introductory “*Fundamentals of Environmental Science*” and 65 did the “*Introduction to Sustainable Development*” in Semester 1.

Staff are cross-disciplinary coming from the following disciplines:

Appendix Box 8		
Multidisciplinary backgrounds of ESG staff		
chemistry	demography	geology
human geography	GIS and Remote Sensing	biodiversity conservation & protected area management
physical geography	education	forestry
biology	community awareness	fisheries
environmental management	ecology	oceanography
law	ecotoxicology	resource management
ecological economics	urban planning	sustainable development

ESG also runs the **Centre for Climate Change and Sustainable Development (CCCSD)** and staff are now also involved in a number of cooperative projects. It runs a number of projects to include the Mangrove Rehabilitation for Sustainably Managed Healthy Forests (MARSH), the April Salumei REDD project, the Reef Habitat Mapping project (with National Fisheries Authority) and EPIC ((Renewable) Energy in Pacific Island Countries with EU and is a solar power project in Pacific with University of South Pacific). The author's Pacific Pesticide Project (run in 2014 with Pesticide Action Network Aotearoa New Zealand and National Toxics Network of Australia) is now based in CCCSD.

In the past Environmental Science has worked closely with both Secretariat of South Pacific Regional Environment Program (SPREP) and PNG Government Department of Environment and Conservation (DEC), this latter from 2015 is now the Conservation and Environment Protection Authority (CEPA). ESG has been heavily involved in assisting and advising DEC on pesticide and chemical management and together with Biology and Chemistry also assisting in the POPs project both in the early 2000s and again now, from October 2014. Now ESG also works with the Climate Change and Development Authority, the Department of National Planning and Monitoring

(DNPM) , with the National Disaster Centre within the Department of Provincial and Local Level Government Affairs, Department of Public Enterprise, the National Weather Service and the Department of the Prime Minister and National Executive Council (NEC).

ESG expects to embark on a major programme in 2017 with both DNPM and UNDP on “StaRS awareness” across the country which will involve region seminars and workshops and involve NGOs and church groups who will act as “StaRS ambassadors or co-educators”

ESG (and Biology) students keep in contact with each other. The social media *Linked-In* (as well as Facebook) is used by many graduates who then continue to communicate with each other forming a formidable network of “Alumini”. The author has communicated with over 250 of ESG and Biology graduates through *Linked-In* over the last 24 months. Some former students have also established the Environment Sustainability Society of Papua New Guinea (ESSPNG) (<https://www.facebook.com/ESSPNG>) and hope to turn it into a professional society. Students at UPNG have formed a very active Environmental Science, Geography and Sustainable Development Association, but involves both students and staff but with students taking the lead roles.

Conclusion on ESG

The Environmental Science Program at UPNG has grown from strength to strength providing excellent training and proving a new vision for new graduates who then gain employment across PNG in the private sector, working with government and with NGOs. The ESG program has grown from a staff of one offering 5 courses in an interdisciplinary program relying on staff from other disciplines to assist and now ESG is a very large discipline offering both co-majors and majors in a number of strands within Environmental Science and Geography including both Demography and Geographic Information Systems and Remote Sensing (GIS).

Since 2015 it now runs a Bachelor of Sustainable Development and a Diploma in Comprehensive Hazard and Risk Management Diploma, soon to be a full degree also. It will also run a Post Graduate Diploma in Physical Planning if the funds are available. It has grown from having about 10-20 students to that from 150 students. Staff come from many disciplines.

The ESG program has become one of the most popular and successful programs at UPNG from strong leadership, passionate and committed staff and enthusiastic students and a most relevant course programme and relevant training. It provides an exciting vision and strong ethical values to the students. Its staff often challenge accepted norms eg brown development , instead advocating ESD or RSD and green development. Some staff are prepared to move out of their comfort zone in doing things and challenging ideas and accepted norms. Some propose a new “World Vision: based on ecocentric values and Earth Wisdom . We take up Charles Abel's pleas for a *development or sustainability revolution in PNG*.

ESG has coupled this with research and consultancy programs and outreach, and has good linkages with government departments, the private sector, NGOS and regional organisations, eg SPREP and its former students. ESG and Biology graduates keep in contact with each other through social media.

ESG also runs the Centre for Climate Change and Sustainable Development and a number of important national and regional programs.

In PNG we need a new breed of person with a clear understanding of the new paradigm of green development or ESD or RSD. We need innovators who move out of their comfort zone. ESG has taken on the challenge to do that training and to spread awareness of the necessity of PNG adopting StaRS.

The Environmental Science and Geography programme at UPNG has proved to be a great success – with a clear mission statement and stated objectives, and a prospectus. It attracts a large number of

students in all years. It has a successful research, consultancy and outreach programme. Its students now work throughout Papua New Guinea, in government, private companies and in NGOs; many communicating with former colleagues and teachers through *Linked-In* and by other means. Many return to do further studies or travel overseas to do so. ESG is prepared to take on challenges, is innovative and prepared to move out of its academic comfort zone. It has now taken on the extra responsibility to teach the cross-disciplinary degree in Sustainable Development, and various diploma and short courses.. ESG and SNPS should be proud to be involved in these initiatives. In PNG we need a new breed of person with a clear understanding of the new paradigm of green development or ESD.

APPENDIX BOX 9

Definitions of Sustainability

Preamble

Both the terms *sustainable development* and *sustainability* now form the central concept in the interdisciplinary subject area called 'Environmental Science' and the new and associated discipline of "Sustainability Science".

Daniel Chiras' popular text is called *Environmental Science* with subheadings as follows: for 3rd and 4th editions – Action for a Sustainable Future; for fifth edition – A Systems Approach to Sustainable Development; for sixth edition - Creating a Sustainable Future. The ninth edition has an initial section on Introduction to environmental protection, sustainability, science and systems, with the first chapter titled "Environmental Science, sustainability and critical thinking". (Chiras, 1991, 1994, 1998, 2001, 2013)

G.Tyler Miller in the 12th and 13th editions of the most popular Environmental Science textbook of all time by G.Tyler Miller, *Living in the Environment: principles, connections and solutions* has as Part 1 a section entitled "Humans and Sustainability". The 14th edition first chapter is entitled "Environmental Problems, their causes and sustainability. Part 2 is entitled "Human Population, Resources and Sustainability. The 17th and 18th editions have the following: part 1:Humans and sustainability, part 2: Science , ecological principles and sustainability; part 3:Sustaining biodiversity; part 4: Sustaining natural resources; part 5:Sustaining environmental quality; part 6 Sustaining human societies , (G.Tyler Miller 2002, 2004, 2012, 2014). Miller has also published a second text titled *Environmental Science: working with the Earth*. Its sections are titled (1) Humans and Sustainability, (2) Ecology and Sustainability, (3) Sustaining Biodiversity, (4) Sustaining Resources and Environmental Quality, and (5) Sustaining Human Societies (Miller,2006).

Many other Environmental Science texts focus strongly on use of these two key terms. Mowbray (2006) in teaching notes at UPNG for "Introduction to Environmental Science: concepts" states that

"Environmental Science is a holistic interdisciplinary study; is not value-free - it is definitely value-laden and has a goal that of seeking to understand root causes and helping to foster the transition to a sustainable future, to sustainable living, to ecologically sustainable development."

Sustainability and Environmental Science are closely linked, as is the new science of sustainability (**Sustainability Science**). Just as evolution is the key concept that holds Biology together, so sustainability is the key concept underlying Environmental Science and Sustainability Science.

All students in ESG and BSD also do **1.12301 Fundamentals of Environmental Science** , where the core themes are '**sustainability**' and '**translating knowledge into action**'..

Searching for a definition of "sustainability"

- We are the first generation with tools to understand the Earth and changes caused by humans and the

last generation with the opportunity to do something positive about it. (modified from quote by Peter Vitousek et al (1997) used by Haydn Washington). We want a future that is not only sustainable but also desirable. (quote from Robert Costanza, from Haydn Washington)

- If we all lived sustainably, then everybody on earth and other living things now and into the future could live like this forever. (modified quote from Bill Grant – friend).
- The ecological crises can be solved. We can reach an ecologically sustainable future.

We say *in cooperation*, yes we can, and yes we will, to develop our country and our world based on sound ecological principles (quote is a modified mix from Haydn Washington and Stacey Onea and Mickey Wembi, two University Students doing course on Introduction to Sustainable Development when addressing Hon Charles Abel PNG Government Minister for National Planning and Monitoring and advocate of responsible sustainable and green development in PNG.in April 2015).

The fundamental objectives Environmental Science and Sustainability Science are to promote social, economic and political change within the ecological constraints of Earth in accordance with the six **principles of:**

1. Ecological sustainability; 2. Social equality and economic justice; 3. Grassroots democracy; and 4. Peace, disarmament and nonviolence; 5. Ecological wisdom and 6 Ecological Justice

The word sustainability is derived from the Latin 'sustinere'

However, whilst there are popular understandings about what sustainability is , the term is used to mean many different things to different persons depending on their World View.

Sustainability is about systems that must be able to be maintained in the long term. A single definition is elusive because it has many dimensions that mean different things to different people.

Furthermore the notion of sustainability is underpinned by ethics and values but based on scientific knowledge.

Sustainability is made up of ecological, social and economic sustainability, as well as institutional (good governance)and personal sustainability so that it means solving the environmental crisis and the entwined social and economic crises.

Sustainability ensures the sustenance of healthy and diverse ecosystems for existing and future generations of humans and other species. To achieve this we need to recognise biological limitations and ecological constraints and that physical growth can not be endless; so we need to maintain biodiversity, ecological integrity, “natural capital”, ecosystem services and ecological integrity. At the same time we need both ecological and social justice and we need to consider economic well-being and social equity issues (both intragenerational and intergeneration equity).

Sustainability is

about a new paradigm (world view) for all living things, including humans; A sustainable system is a global ecological and societal system that persists forever. It is something we must be able to measure so we know how we are doing and where we are going;. It represents a new way of life and approach to social and economic activities for all societies, rich and poor, which is compatible with the preservation of the environment. It recognises the inherit rights for all life to live in healthy and sustainable environments ; it is about ecological justice; it recognises the ecological limits of the Earth, or its biocapacity; Sustainability refers to maintaining ecosystems and existing species so that they may coexist; this involves the necessity of humans adjusting their lifestyles and reducing their ecological footprints to ensure the resilience and sustainability of ecosystems and all species; it is the protection of ecosystems so as to support human society with equitable access to natural resources forever; It leads to social justice and human well-being where ecological, social , economic and institutional sustainability aspects are prioritised.. It encapsulates is about ecological wisdom ; it is about returning in part to the old world view that our ancestors understood and indigenous cultures in many places still do . Sustainability practioners acknowledges that the wisdom of the elders in most societies was a way of life that was sustainable. It emphases strong sustainability not weak

sustainability and is not about 'business as usual solutions'; Sustainability ensures all humans equally share the earth's resources using them sustainably; this necessitates a fundamental change in education systems about the science and history of life on earth; and the impact of humans as one species on all other species and ecosystems and how we can minimise this. Environmental and sustainability sciences integrates environmental, economic and social aspects into decision-making with institutional sustainability and good governance; it involves improved valuation, pricing and incentive mechanisms so as to ensure that environmental factors are included in the valuation of assets and services ; and recognises that critical natural capital can not be transformed into other forms of capital - for example - biodiversity should be valued for itself (intrinsic value) , while ecosystem services are critical for society's existence.

In seeking sustainability solutions in decision-making the precautionary principle needs to be rigorously applied ; this is important to minimise negative and unacceptable risks (it is often only tokenly applied today); here actions should reflect risk and uncertainty based on the precautionary, polluter-and user- pays principle, intergenerational equity, intra-generational equity, free prior and informed consent and helping (involuntary) risk-bearers to participate in decisions as well as risk- takers;

Sustainability science recognises that economic sustainability requires we abandon the fundamentally unsustainable endless growth economy of Capitalism and Neoliberalism and move to a green and ecological economics based on the Earth's limits, and eventually and arguably a steady state economy.

Sustainability science is an obligation to conduct ourselves so that we leave to the future the option or the capacity to live in a sustaining environment . We need conduct ourselves in a manner to heal the world we have damaged to give future generations the greatest well being we can. This is both an ethical and realist and prudent viewpoint. In seeking sustainability solutions we humans must adopt a healing role within ecosystems – and particularly human-influence ecosystems such as farmland and urban areas – is to undo previous damage and build the sustainable carrying and assimilative capacities of systems. For example – rebuilding depleted soils so they are more productive and perform a wider range of ‘ecological services’ such as carbon storage, storm water run off absorption or waste water ‘filtering’; In reality, sustainability is the optimal balance of natural, economic, and social systems over time; it involves economic sustainability as being based on ecological economics involving either a steady state economy or a green economy (may differ at present between the over-developed world and the developing world). It also provides us with ecological justice and transforms our ethics, values and world view.

Non-sustainability or Unsustainability

We must recognise that humanity has exceeded ecological limits. And in some instances passed planetary boundaries (eg green hose gas emissions and loss of biodiversity).

We are no longer living with in the bio-capacity of Earth's ecosystems. The Earth's resources have slipped into an ecological deficit'. We are taking more from Nature than the Earth's ecosystems can supply. This means we are using up the planet's natural resources available for one year in much less than one year. In 2016 we passed this point in August. We are now living with an ecological deficit!! It is estimated that 86% or more of the world's population live in countries that that require more from Nature than their ecosystem can provide.

When will economists and politicians wake up to this simple message!!!!???

We are living non- sustainably or unsustainably. Consequently sustainability must be about repairing the Earth as well as seeking better and sustainable livelihoods for all peoples , and “enoughness” for all - whilst respecting all other life and maintaining a sustaining environment and healthy ecosystems.

Some definitions from Academia

These are commonly used definitions we give to students in Environmental Science (though vary in choice of words)

Sustainability is

the “ ability of Earth's various systems , including human cultural systems and economics, to survive and adapt to changing environmental conditions indefinitely”.

(from G.Tyler Miller 2015 Living in the Environment 18 th edition)

is a pattern of development that improves the total quality of life of all peoples, and respects other forms of life in a way that maintains the ecological processes on which all life depends.. and living within the carrying capacity of supporting ecosystems.”.

(modified from Environment Australia, 1996 and WWF Caring for the Earth ; The World Conservation Strategy., 1990)

is a process that leads to social equity and human well-being where ecological, social, economic and institutional aspects are prioritised require and ecological components that ensure the sustenance of a healthy and diverse ecosystem on behalf of existing and future generations of humans and other species. To achieve this we need to sustain biodiversity, ecological integrity, “natural capital” and social equity and recognise ecological constraints and biological limitations.

My definition of sustainability is as follows:

Sustainability

is where the ecological processes on which all life depends are maintained, and where humans live within the carrying capacity of supporting ecosystems; and work to restore and enhance degraded ecosystems;

is the type of system that survives or persists forever , eg ecological or ecosystem, or a society is a commitment to the continual coexistence of humans with other living things on Earth;

is where humans live within the carrying capacity of supporting **ecosystems**;

is about matching wants and needs such that humans minimise our ecological footprint by changing our ways so we do not in future exceed the Earth's biocapacity;

also is about ensuring the well being, social equity, economic well-being for all peoples and ecological justice for nature as well as social justice for people; and constraints on human impact preclude endless growth of human populations and material consumption and destructive technologies.

ALTERNATIVE DEFINITION BY Dr Ron Martin of ACER (friend)(Australian Council for Educational Research) has suggested

Sustainability

- refers to the ability of the Earth’s current ecosystems, of which humans are a part, to persist into the indefinite future
- necessitates people being ecologically aware and living within the carrying capacity of supporting ecosystems;
- requires the ecological processes on which all life depends being maintained;
- confines the wants and needs of humans to the bio-capacity of Earth’s ecosystems;
- commits humans to valuing the continued existence of all other living species;
- ensures the well being, social equality, and economic equality of all people on Earth;
- maintains the Earth’s resources during the energy flows and transformations in ecosystems, including those involved in human consumption and use of resources.

There are many ways we can view this such important concept that is the core of both Environmental and Sustainability sciences. But environmental science emphasis strong sustainability. Weak sustainability or 'business as usual” sustainability remains part of the old paradigm and is part of a world view that is anthropocentric and believes in planetary management.

Environmental scientist reject this.

It is important we do understand what **strong sustainability** is if we are to find sustainability solutions to all our problems, both local and global; and so heal both our Earth and all living things; and all people who live now and will live in the future

I have not produced a reference list as all citations are listed in the reference list that comprises Appendix Box 10.

APPENDIX BOX 10

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Reference and Acknowledgement

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and at the National Centre for Development Studies at the Australian National University (1997-2001). He taught Biology here from 1977-1991, and Environmental Science from 1991 to 1997, and from 2001 to 2008, and both Environmental Science and Sustainable Development from 2014 to the present.

At present he assists to co-ordinate the Sustainable Development programmes in Environmental Science and Geography at University of Papua New Guinea.

He runs the Pacific Pesticide Project working with 20 countries in the Pacific, with SPREP and with the Pesticide Action Network for the Pacific. He has also advised the Department of Environment and Conservation, now the Conservation and Environmental Protection Agency, on pesticides and chemical management matters since 1977.

He was on the UN committee that established the Rotterdam Convention in the late 1980s and early 1990s. He was a member of a discussion group that led to the formation of the Waigani Convention.

He teaches the introductory Environmental Science course and the two introductory Sustainable Development courses, the new Environmental Science and Sustainability course, the Pollution Science course, the Green and Ecological Economics course and the Research Techniques and Skills courses.

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