

Biodiversity and the Value of Natural Ecosystem Services in the Waikato Region

I made this presentation to the Environment Committee of Waikato Regional Council back in 2003. It gives a basic overview of the concept of valuing ecosystem services. It is amazing how little was understood then about this concept.

Now in 2013, thanks to the support of central and regional government the National Wetland Centre (complete with pest-proof fence) was established in the Waikato region, a few kilometres south of Hamilton.

INTRODUCTION

It is not easy to unravel concepts such as biodiversity, sustainability, and natural ecosystems services. But being able to understand what each term means, and its relationship to the others, is critical to recognising how future generations would be able to exist on planet Earth.

We present today are only 'passing through'. It would be arrogant of us not to ponder on the results of our activities (the size of the footprints we leave behind). We have not been given the right to take on anything other than the role of stewardship of the planet while we are here.

The very existence of future generations on Earth is dependant on how seriously we take the responsibility of that stewardship role. If we don't exercise the 'ethics of restraint' then we are denying those who follow us, the opportunities that we took for ourselves. Can we live with that?

The natural resources on Earth are of a finite nature ie there is a limit to them. We are blessed with the **gift of infinite intelligence but rarely infinite wisdom**. We must find solutions to the downsides of consumerism and exploitation. To say to future generations (our children, grandchildren etc) "sorry, while we were here, we didn't care, we were too greedy" is a position and an attitude difficult, if not impossible, to defend.

DEFINITIONS

To help us unravel in our minds the connections between biodiversity, sustainability and natural ecosystems and their services we need to look at some definitions.

1. Biodiversity

This is an abbreviation of the words 'biological diversity'. It is the variety of all biological life ie plants, animals, fungi, and micro-organisms – the genes they contain and the environments on land or in water where they live. It is the diversity of life on earth.

2. Sustainability

- a. "sustainability is maintenance in being or activity especially in a certain condition or at a certain level" (Oxford Dictionary)

- b. It is an attitude of mind. It is recognition of the need to facilitate a situation in which natural renewable resources are not consumed faster than they can regenerate and
- c. It is a decision-making process that always accounts for the long-term impacts of activities.

3. *Natural Ecosystems*

Living communities (a population of species) and their specific non-living environments. Natural ecosystems reflect the collective life activities of plants, animals and microbes, and the inter-relationships of the effects of these activities –feeding, growing, moving, excreting waste etc- have on the physical and chemical conditions of their environment.

4. *Natural Ecosystems Services*

Examples of natural ecosystems services, sensitive to the numbers and kinds of species found in their communities, are:-

- a. pollination (33% of human foods are derived from plants pollinated by wild pollinators such as birds)
- b. dispersal of seeds
- c. pest control (99% of our pests are destroyed by flies, birds and wasps)
- d. climate stabilisation and mitigation of floods and droughts
- e. protection of coastal shores by erosion from waves
- f. protection from the sun's ultra violet rays and
- g. production and maintenance of biodiversity

Three examples of Natural Ecosystems and the Services they provide important to the Waikato are:

1. Wetlands

Think of these as the kidneys of the land. Think of them as giant filtering sponges that:

- a. Filter pollutants out of runoff and ground water and thereby protect water quality
- b. Trap waterborne sediment, faecal bacteria, nitrogen and phosphorus from runoff. The bacteria living in damp wetland soil can convert up to 90% of the nitrogen from farm runoff into nitrogen gas which is then released into the atmosphere. Algal bloom and other nuisance plant growth is thereby controlled. 90% of sediment can be trapped in an effectively constructed filter strip.
- c. Provide habitat for eels, native fish, birds and insects, thereby improving local biodiversity
- d. Assist in the reduction of flood peaks
- e. Maintain summer water flows
- f. Reduce stock losses and improve stock management (if fenced).

In the Waikato region, the 100,000 hectares of wetlands present in 1840 has diminished to 30,000 hectares today.

2. Soil

Soil contains both soil animals and soil micro-organisms. A pinch of fertile soil contains 30,000 protozoa, 50, 000 algae , 400,000 fungi and billions of individual bacteria. (A square metre of pasture in Denmark contains 50,000 small earthworms, 50, 000 insects and mites, and 12 million roundworms). On a hectare of land, 10 metric tonnes of material pass

through earthworm bodies in one year resulting in nutrient rich casts that enhance soil stability, aeration and drainage.

Other services supplied by soil include:-

- a. moderation of the water cycle ecosystem.
- b. shelter for seeds and physical support as they sprout
- c. storage and delivery of nutrients to plants. (Worldwide there are a few thousand hectares in hydroponics, but 1.4 billion hectares being cropped).
- d. detoxification and decomposition of wastes involving the life cycles of bacteria thus rendering harmless many potentially harmful human pathogens. Simple inorganic chemicals that result from decomposition are returned to plants as nutrients and
- e. regulation of the Earth's major element cycles being carbon, nitrogen and sulphur

In the past it has been acceptable to sustain farm production by adding more pesticides, water and fertilisers. In future, better management of soil flora and fauna that sustains the environment and its natural ecosystems will be necessary if such services provided by the soil are to continue.

3. Forests

Forests are an example of another ecosystem that provides direct and indirect benefits. Timber production is the obvious economic gain for humans but indirectly forests have an important role in

- a. climate control, by regulating the flow of substances and gases such as CO₂
- b. erosion control
- c. water regulation by moderating runoff and flood events
- d. biodiversity by providing habitat for species and
- e. recreation

THE VALUE OF NATURAL ECOSYSTEMS SERVICES

It is standard practice to measure the economy's outputs in terms of the amount of Gross Domestic Product (GDP) but this method does not take into account a measure of how well we are looking after our environment on whose health status the amount of GDP ultimately depends.

To put a value on natural ecosystems in dollar value terms we should consider the benefits within three categories:-

a. the billions of dollars traded on seafood, game animals, fodder, fuel, wood, fibre, timber, and pharmaceutical products. (A recent survey showed that of the top 150 prescription drugs used in the United States, 118 are based on natural sources: 74% on plants, 18% on fungi, 5% on bacteria, and 3% on one vertebrate (snake) species.) These are direct values derived from goods and services derived from direct use of natural resources and ecosystems traded on commercial markets.

b. the immeasurable numbers of dollars derived from recreation, rejuvenation, knowledge and the aesthetics of natural beauty that lift the human spirit.

c. the many trillions of dollars annually (not traded in the market place) from fundamental life-support services without which human civilizations would cease to thrive

For example, in the Waikato, where GDP for the region was \$9.9 billion in 1997, the value of ecosystem services was estimated at \$9.4 billion. If we revisit the three examples of ecosystem services given above, estimates on their indirect values have been prepared for EW at:-

Wetlands	\$1,211 million	12.9% of total GDP value
Agriculture/ Horticulture	\$1,460 million	15.6% of total GDP value
Forests	\$1,856 million	19.8% of total GDP value

These indirect values are based on the support and protection offered by ecosystems for the production of tradable commodities. Water based ecosystems yield approximately twice (64%) the total value of land based ecosystems (36%).

BIODIVERSITY

Having established the concept of the value of ecosystems services then we need to understand that natural ecosystems services are sensitive to the numbers and kinds of species (biodiversity) found in their communities. Biodiversity and natural systems are inextricably inter-woven and interdependent. We simply do not understand the complexity of species inter-relationships, nor which assemblies of species we rely on to maintain our life support systems in good health.

It is also critical to recognise that natural ecosystems provide a wide variety of living conditions and chance events that shape the evolution of organisms thus maintaining the earth's biodiversity. If natural ecosystems are compromised through such activities as overuse, over-loading, and destruction, then there will be a resultant decline in the services from which we could expect to benefit, including a decline in biodiversity and with that future genetic material.

Studies now indicate that biodiversity can be a measure of sustainability. This has important implications. It means that direct economic benefits can be shown to flow on from encouraging and enhancing biodiversity in all aspects of biologically dependant production. To farm profitably long term, decisions made by farmers must take into account the economic benefits of biodiversity.

Biodiversity provides key ingredients for our agricultural, pharmaceutical, and industrial enterprises. The potential benefits of genetic resources for crop breeding and natural pest control services must be preserved for the needs of future generations.

In our ignorance, it would be easy to allow critical species to become depleted or extinct, thus degrading the life support process. A conservative estimate of the rate of species loss is about one per hour, which unfortunately exceeds the rate of evolution of new species by a factor of 10,000 or more. In the Waikato region alone, more than 75% of our native vegetation has been cleared. Furthermore, 50% of surviving areas are unprotected from plant and animal pests.

We have to get away from the idea that biodiversity is just protecting patches of bush and wetland and seeing more kiwis and kereru. Rather it extends from soil bacteria to stream care, from shelter-belts to pasture composition. It reaches from genetic variation within a species, to maintaining viable populations of rare breeds, or plant varieties.

Having said that encouragement of biodiversity is critical to our support systems, the special place of our indigenous and precious unique NZ biodiversity must be maintained. It would be fair to say that decisions made in the first decade of this century could be critical in the survival of much of our indigenous biodiversity.

CONCLUSION

Based on available scientific evidence, it is certain that:

- a. Humanity came into being after most ecosystem services had been in operation for hundreds of millions to billions of years. Historically, the nature and value of Earth's life support systems have largely been ignored until their disruption or loss has highlighted their importance. Human activities are already impairing the flow of ecosystem services on a large scale for short-term economic benefits. The sustainable population for the planet is approximately 2 billion. If current trends continue, humanity will dramatically alter virtually all of Earth's remaining natural ecosystems within a few decades
- b. Ecosystem services are essential to civilization. They operate on such a grand scale and in such intricate and little-explored ways that most could not be replaced by technology. Very large numbers of species and populations (biodiversity) are required to sustain ecosystem services
- c. Vibrant biodiversity is evidence that our natural ecosystems are being sustainably managed for future generations.
- d. We must look upon biodiversity and the services provided by ecosystems as "dollars in the bank".

WHAT TO DO?

To be proactive rather than reactive is the only option. Land use and development policies should strive to achieve a balance between sustaining vital ecosystem services and pursuing the worthy short-term goals of economic development. Resource consent applications must include a value for the ecosystem depletion incurred and this value must be taken into account before an application is approved. Staff at EW have the ability to assist in this area.

An holistic approach to the management of our biodiversity and a Regional Biodiversity Strategy for Waikato is essential if we are to meet our obligations in this regard. The functioning of many ecosystems could be restored if appropriate actions were taken in time.

The work of EW's Resource Information Group is critical in measuring and monitoring today's natural ecosystems. It will provide us with our biodiversity reference library by which future generations will be able to judge the success or otherwise of our role as today's stewards.

REFERENCES:

Issues in Ecology, published by the Ecological Society of America. Spring, 1997 and Fall, 1999.

