Biodiversity , Roles and Current Challenges

Presented on Word Biodiversity Day

By

Debela H.Feyssa (PhD, Professor),

Jimma University, College of Agriculture & Vet. Medicine

22 May 2018, Jimma University, Ethiopia

Biodiversity: What is it, where is it, and why is it important?

- **Biodiversity is the variety and variability among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part;**

✓ **this includes diversity within species, between species, genes and of ecosystems.**

What is Biodiversity….

- **Biodiversity forms the foundation of the vast array of ecosystem services that critically contribute to human well-being.**
- **Biodiversity is important in human-managed as well as natural ecosystems.**

What Is Biodiversity?

- **No feature of Earth is more complex, dynamic, and varied than the layer of living organisms that occupy the earth surfaces and aquatic environments (seas, oceans, rivers, lakes, etc)**
- **no feature is experiencing more dramatic change at the hands of humans than this extraordinary, singularly unique feature of Earth.**

What Is Biodiversity?...

- **This layer of living organisms the biosphere through the collective metabolic activities of its innumerable plants, animals, and microbes physically and chemically unites the atmosphere, geosphere, and hydrosphere into one environmental system within which millions of species, including humans, have thrived.**

What Is Biodiversity?...

- Breathable air,
- potable water,
- fertile soils,
- productive lands,
- bountiful seas, oceans, lakes, rivers,wetlands,
- the equitable climate of Earth's recent history,
- other ecosystem services are manifestations of the workings of biodiversity.

What Is Biodiversity?...

- large-scale human influences over this biodiversity have tremendous impacts on human well-being.
- the nature of these impacts, good or bad is largely within the power of humans to influence .

What Is Biodiversity?...

- **Biodiversity is essentially everywhere, ubiquitous on Earth's surface and in every drop of its bodies of water.**
- **The virtual omnipresence of life on Earth is seldom appreciated because most organisms are small,**
- **their presence is sparse, ephemeral, or cryptic,**
- **in the case of microbes, they are invisible to the unaided human eye .**

What Is Biodiversity?...

- Biodiversity benefits people through more than just its contribution to material welfare and livelihoods.

Biodiversity contributes to:

- security,
- resiliency,
- social relations,
- health, and freedom of choices and actions.

Changes in biodiversity

- Changes in biodiversity due to human activities were more rapid in the past 50 years than at any time in human history,
- drivers of change that cause biodiversity loss and lead to changes in ecosystem services are either steady, show no evidence of declining over time, or are increasing in intensity.
- these rates of change in biodiversity are projected to continue, or to accelerate.

Changes in biodiversity….

- Many people have benefited over the last century from the conversion of natural ecosystems to human dominated ecosystems and from the exploitation of biodiversity.
- At the same time, however, these gains have been achieved:
- at growing costs in the form of losses in biodiversity,
- degradation of many ecosystem services, and the exacerbation of poverty for other groups of people.

Causes of Changes in biodiversity….

- The most important direct drivers of biodiversity loss and ecosystem service changes are:
- habitat change (such as land use changes, physical modification of rivers or water withdrawal from rivers, forests, grasslands),
- loss of coral reefs, and damage to sea floors due to trawling),
- climate change,
- invasive alien species,
- overexploitation,
- pollution.

Causes of Changes in biodiversity….

- Why are we losing so many species and swathes of land every single second?
- Biodiversity has declined by more than a quarter in the last 35 years.
- In general terms, population growth and our consumption are the reasons for this enormous loss.
- Specifically, habitat destruction and wildlife trade are the major causes of population decline in species.

Causes of Changes in biodiversity….

We have...

- Picked
- logged,
- plucked and
- hunted

the

- animals,
- trees,
- flowers and
- fish

Causes of Changes in biodiversity….

for : medicine,

- souvenirs,
- status symbols,
- building materials and
- Food and this over-exploitation (**hunting, fishing, by catch**) is currently totally unsustainable.

Adding to the pressure is Climate Change - the full effects and impacts on Biodiversity and how life may (or may not) adapt is still very much an unknown quantity.

Causes of Changes in biodiversity….

- Climate, biodiversity and human wellbeing are inextricably linked.
- Our understanding of these issues, the relevant processes and their inter-relationships is not complete.
- New mechanisms will be needed to galvanise work in this area, especially at local , national and the intergovernmental level.

Causes of Changes in biodiversity….

- Significant climate change impacts on biodiversity have already been identified with up to 50% of the species studied world-wide observed to be affected.
- The Inter-governmental Panel on Climate Change (IPCC, 2007) concludes that if temperature increases exceed 1.5-2.5°C, 20-30% of plant and animal species assessed are likely to be at risk of extinction.

Causes of Changes in biodiversity….

- The continuing accelerating loss of biodiversity could compromise the long-term ability of ecosystems to regulate the climate,
- may accelerate or amplify climate warming and could lead to additional,
- unforeseen, potentially irreversible shifts in the earth system.

Causes of Changes in biodiversity….

- Crucially, higher genetic and species diversity tends to make ecosystems more resistant and resilient to disturbance.
- This is because species are more likely to be present with characteristics that will enable the ecosystem to adjust to environmental change.
- This means that ecosystems can continue to function and provide critical services such as water purification.
- As biodiversity declines, so too does the resilience of the system .

How many species are we losing?

- **Unlike the mass extinction events of geological history, the current extinction challenge is one for which a single species ours appears to be almost wholly responsible.**
- This is often referred to as the 6th extinction crisis, after the **5 known extinction waves in geological history.**
- without arguing about who's right or wrong.
  Or what the exact numbers are.
  There can be little debate that there is, in fact, a very serious biodiversity crisis.

How does Biodiversity loss affect everyone?

There may be a biodiversity crisis, but how does that affect everyone?

- Biological diversity is the resource upon which families, communities, nations and future generations depend.
- It is the link between all organisms on earth, binding each into an interdependent ecosystem, in which all species have their role. **It is the web of life**.

How does Biodiversity loss affect everyone else?

- The Earth's natural assets are made up of plants, animals, land, water, the atmosphere and humans! Together we all form part of the planet's ecosystems, which means if there is a biodiversity crisis, **our health and livelihoods** are at risk too.
- As a result species, habitats and local communities are under pressure or direct threats (for example from loss of access to fresh water).

Biodiversity underpins the health of the planet and has a direct impact on all our lives.

- Reduced biodiversity means millions of people face a future where food supplies are more vulnerable to pests and disease,
- fresh water is in irregular or short supply. For humans that is worrying, Very worrying indeed.
- Human health is strongly linked to the health of ecosystems, which meet many of our most critical needs.

Distributional Impacts of Biodiversity Loss and Ecosystem Change….

- **Provisions for ensuring the equitable distribution of monetary benefits from the use of biological products are an issue of major concern.**
- **Even in cases where equitable provisioning has been made, implementation is being impaired by weak and ineffective institutions .**

Biodiversity and Livelihoods

- The components of human wellbeing were defined by the Millennium Ecosystem Assessment (2005) as:
- security,
- basic material for a good life,
- health, good social relations,
- freedom of choice and action, all of which depend either directly or indirectly on ecosystems and the services they provide (and therefore on biodiversity).

Four categories of services provided by ecosystems to society…

- Regulating services provide the mechanisms that moderate the impact of stresses and shocks on ecosystems (Kinzig et al, 2006) and include, for example, climate and disease regulation.
- Regulating services determine the distribution of provisioning services, such as food, fuel and fibre, and cultural services such as spiritual and aesthetic values (Kinzig et al, 2007).

Four categories of services provided by ecosystems to society….

- provisioning and cultural services (eg food, fibre, recreation and aesthetics respectively) which represent a relatively small component of biodiversity.
- However, the supply of these services is underpinned by supporting and regulating services, (for example pollination, climate regulation and primary productivity respectively), for which the value of biodiversity is less visible but no less important (Scholes & Midgley 2007, Kinzig et al, 2007).

Four categories of services provided by ecosystems to society…

- Biodiversity loss, ecosystem degradation, and consequent changes in ecosystem services have also led to a decline in human wellbeing in some groups by exacerbating poverty and increasing inequities and disparities (MA, 2005).

Biodiversity and Livelihoods

What are the main links between biodiversity and human well-being/ Livelihoods?

1. Food security
2. Vulnerability
3. Health
4. Energy security
5. Provision of clean water
6. Social relations
7. Freedom of choice and action
8. **Basic materials for a good life and sustainable livelihood**s

Biodiversity and Livelihoods…

- **hence for human well-being.**
- **Biodiversity goes beyond the provisioning for material welfare and livelihoods to include security, resiliency, social relations, health, and freedoms and choices.**
- **Some people have benefited over the last century from the conversion of Biodiversity is essential for ecosystem services and natural ecosystems to human-dominated ecosystems and from the exploitation of biodiversity.**

Biodiversity and Livelihoods…

- **At the same time, however, these losses in biodiversity and associated changes in ecosystem services have caused other people to experience declining well-being, with some social groups being pushed into poverty.**

Biodiversity and Livelihoods…

- Biodiversity is central to sustainable development.
- It is critical for reducing poverty, creating sustainable livelihoods and helping communities adapt to climate change.
- It is the lifeblood of sustainable development and green economies.
- Yet it is being depleted at an unprecedented rate as human populations, and their levels of consumption, increase.

Biodiversity and Livelihoods…

- Biodiversity underpins the delivery of a wide range of essential goods and services on which we all depend: food, fodder, fibres and medicines.
- Poor people in rural areas of developing countries are disproportionately dependent on these goods and services to meet their day-to-day survival needs.
- To them, biodiversity is a safety net, a natural health service and an insurance strategy.

Commercial Importance

- Humankind derives many benefits from forest ecosystems.
- Many medicines and pharmaceuticals have been discovered in plants native to forests.
- Local communities survive on plants and animals culled from the forests.
- Products that modern society depends on such as wood, paper and bamboo all originate from forest ecosystems.

Commercial Importance…

- Many other desirable products such as spices, gums and dyes, even your daily vitamins are also found in forests around the globe.
- Forests are important to humans for aesthetic reasons as well, ecotourism is one way to use and promote the protection of forests in a sustainable manner.
-

It is also about food security…

- Climate change will bring about changes in temperature and rainfall distribution, which in turn will affect both the functioning and boundaries of ecosystems.
- Some ecosystems will expand into new areas, while others will shrink, and the habitats they contain will alter.
- Unless species are rapidly able to adapt there is likely to be a sharp increase in extinction rates.

It is also about food security…

- Climate change is predicted to hit the poorest countries and people the hardest.
- Given that the poorest people also tend to be those most dependent on biodiversity for their day-to-day livelihoods, some of the world's most vulnerable people will have their lives negatively affected by the combined loss of biodiversity and the increasing impact of climate change.

Various management options exist

- Various management options exist to promote adaptation.
- The risks can be partly mitigated by adhering to a number of general forest management recommendations,
- which maintain resistance and resilience based on forest biodiversity:
  - Maintain genetic diversity in forests by not selecting

Various management options exist…

- only certain trees for harvesting based on site, growth
- rate, or form.
  - Maintain stand and landscape structural complexity
- using natural forests and natural processes as models.

Various management options exist…

Maintain connectivity across forest landscapes by:

- reducing fragmentation,
- recovering lost habitats (e.g.. forest types, grassland, etc),
- expanding the protected area networks,
- establishing ecological corridors.
- Marinating functional diversity
- eliminate conversion of diverse natural forests to monotypic or reduced species plantations.

Various management options exist…

- Manage semi-natural forests in a sustainable manner that recognizes and plans for predicted future climate.
- For example, hedge bets by apportioning some areas
- of assisted regeneration with trees from regional
- provenances and species from climates of the same region that approximate expected conditions in the future, based on climate modeling.

Various management options exist…

- Maintain biodiversity on all scales (stand, landscape, bioregion) and elements (genetic, species, community, ecosystems),
- protect isolated or separate populations of trees, populations at margins of their distributions, source habitats and refugia networks.
- These populations are the most likely to represent pre-adapted gene pools for responding to climate change and could form core populations as conditions change.

Various management options exist…

- Ensure that there are national and regional networks of scientifically designed, comprehensive, adequate and representative protected areas.
- Build these networks into national and regional planning for large-scale landscape connectivity.

Various management options exist…

- Reduce non-natural competition by controlling
- invasive species and reduce reliance on non-native tree crop species for plantation, afforestation or reforestation projects.

Restoration of ecosystems

- The restoration of forest ecosystems can also be a
- cost-effective ecosystem-based adaptation strategy.
- Restoration activities include limiting human activities,
- such as logging, to allow ecosystems to recover,
- or restoring ecological components such as habitat connectivity or water regimes, through activities such as re-flooding wetlands.

For example, an alternative to constructing additional dams or reservoirs for increased floodwater storage could be flood plain restoration, which would also improve riparian habitats.

Restoration of ecosystems…

Despite the fact that the area is still used for food production,

- **local residents are often displaced from their fishing grounds,**
- **the fish produced are usually not for local consumption but for export.**
- **Coastal residents often no longer have access to cheap protein or sources of income .**

Thank you!