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ICEEE

Climate Change Interactions with Agroecosystem, Food Security and Goals of Sustainable Development

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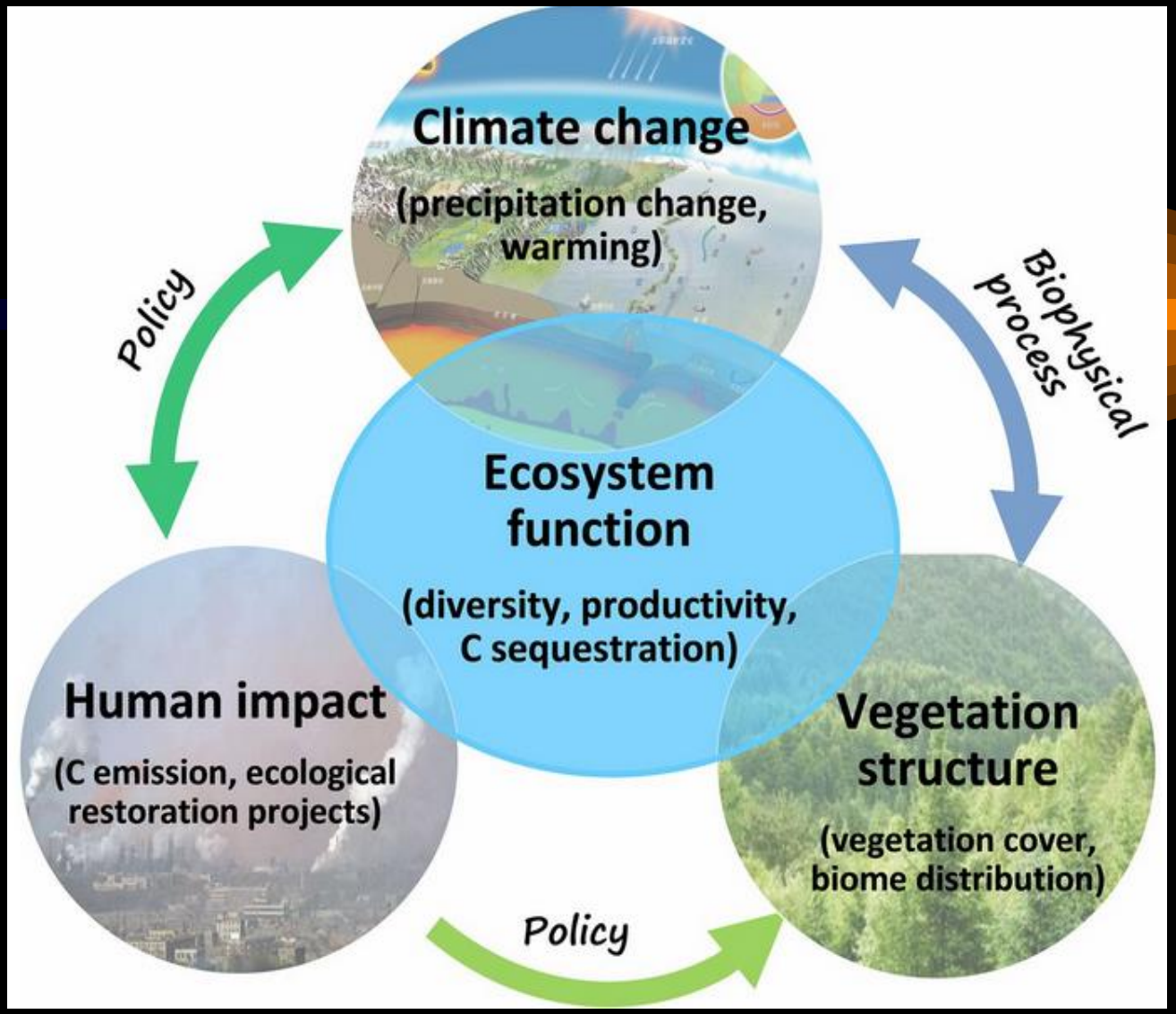
Introduction

- World are concerned with solving the global environmental pollution problem due to industrial development, increase in rate of the worldwide population, and rise in the standard of livings which increases the climatic changes.
- Globally, more food production, protection and enhance the natural environment without damaging the natural resources are needed.
- Climate change has negative effects on securities of food, water and energy due to extreme changes in the environmental properties such as floods, droughts, and heat waves, and reduces agroproductivity.

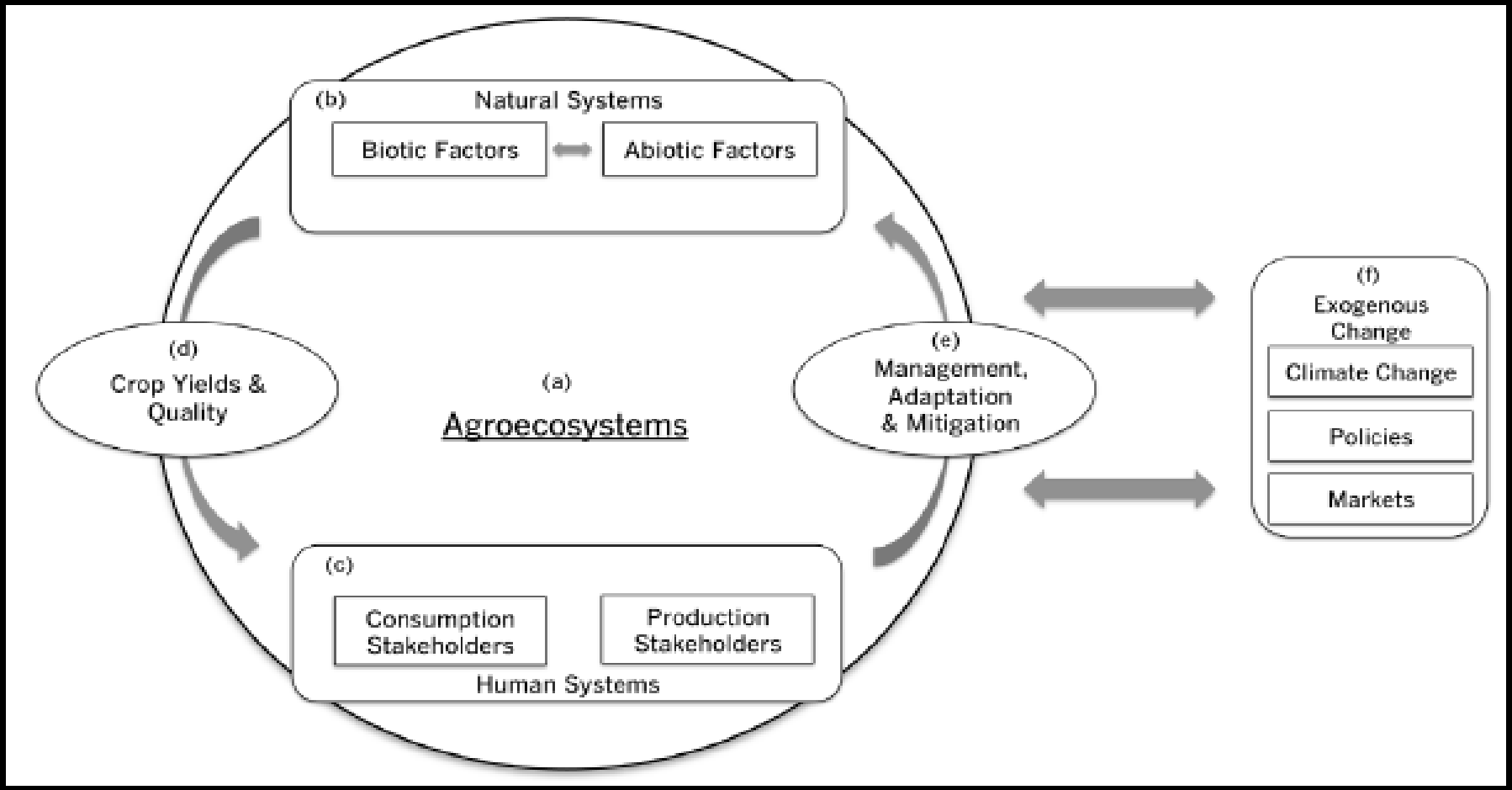
CLIMATE CHANGE

- Climate change is a serious global problem that biosphere encounter in the present.
- Due to technological advancement and continuous innovation, they directly affect the atmosphere which causes climate change.
- Human activities are solely responsible for the actions.



Conceptual diagram showing how vegetation structures, climate changes, and human activities influence ecosystem functioning

- Climate change is impacting the sustainability of food systems through shifts in natural and human dimensions of agroecosystems that influence farmer livelihoods, consumer choices, and food security.

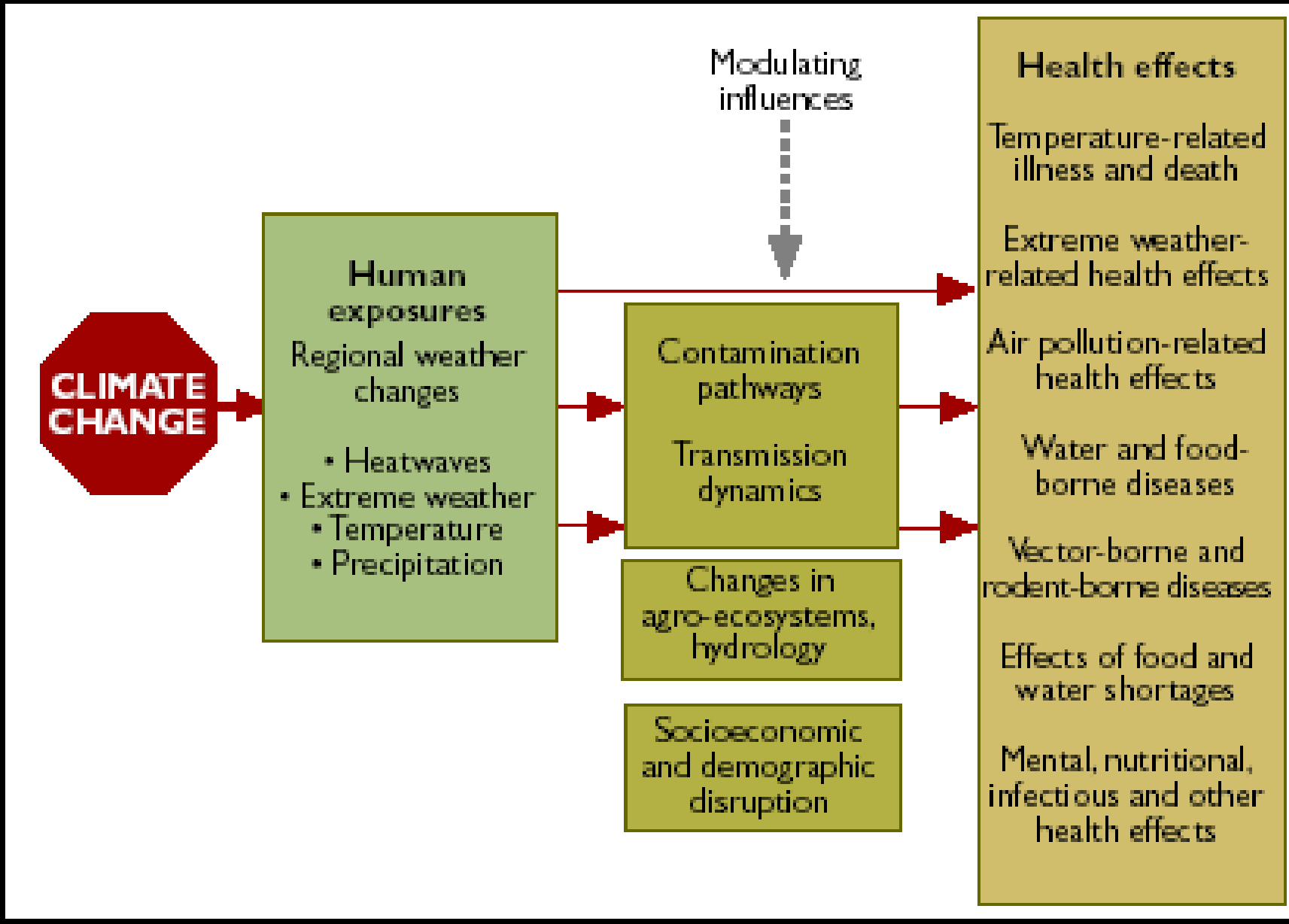


Socio-ecological systems framework to examine climate effects of crop quality and farmer responses

Climate change has consequences for:

1. global food sources (Lithosphere),
2. health (human, animal, and plant),
3. weather (atmosphere) and
4. oceans (hydrosphere).

The effect of climate change is the occurrence of longer and more frequent drought and flood that put challenges in growing crops, the animals shift to another places to live and the water supply diminish.



Pathways by which climate change affects on human health

- It also affects physical health especially in urban areas where the air is polluted.
- In these scenarios, the application of engineering principles are important in solving problems especially in soil and water management, soil and water conservation engineering.

Agricultural engineer has a great role in solving engineering problems that involve in soil and water conservation programmes such as:

- erosion control,
- drainage,
- irrigation,
- flood control,
- moisture conservation and
- water resource development.

Climate change and land use change are considered as the most important threats to ecosystems.

Both factors can be expected to have interacting influences on ecosystem functions directly and indirectly via changes in biodiversity.

Knowledge about these interactions is limited due to a lack of experiments which investigate climate change effects under different land use scenarios.

- Especially in agroecosystems, biodiversity is directly and indirectly controlled by increasing land management intensity, suggesting a varying relative importance of other global change factors.

- In global climate change is the most important ecological factors influencing agricultural production and agroecosystem are:
  - elevated atmospheric CO_2 concentration,
  - enhanced air temperature, and
  - changed precipitation, which mainly exert on:
    - crop output,
    - crop growth,
    - diseases and pests,
  - agricultural water resources, and
  - structure and function of agroecosystem.

- Globally:
- More food production, protection and enhance the natural environment without damaging the natural resources are needed.
- With the challenge of climate change and a growing world population, it is necessary to ensure that we can feed ourselves in the following years to come by growing enough food sustainably.

Countries all over the World are concerned with solving the global environmental pollution problem due to:

1. industrial development,
2. increase in rate of the worldwide population, and
3. rise in the standard of living which increases the climatic changes.

Agroecosystems should produce much greater amounts of food, fodder, fiber, etc. to meet:

1. the global needs,
2. improve human health and social life,
3. reduce dependence on traditional fuels,
4. adapt to climate change, and
5. reduce environmental degradation and decline in soil quality.

There are several limitations in food production over the worldwide due to:

1. food chain and water (pollution) contamination by pesticide residues, and pest control,
2. reduction in nutrients,
3. climate change,
4. increasing food and fuel prices,
5. soil erosion,
6. fertility loss,
7. biodiversity depletion and
8. decreases in agricultural land areas used for food production.

Recognizing:

- the environmental bases,
- self-regulating ability and agroecosystem stability,
- agrobiodiversity,
- climate change and global warming,
- soil nutrients and etc. and
- agroecosystem health which are the most significant environmental issues regarding the food production systems.

CLIMATE *CHANGE*

- Global climate change is a dynamic, multidimensional system of changes in environmental conditions that will likely influence human behaviour.
- Climate change is the greatest long-term threat facing the world.
- Climate change is one of the biggest problems which is due to the emissions of greenhouse gases causing the global warming.

- Climate change is a phenomenon in which global perspective having a range of effects at various levels among the social and industrial sectors.
- Weather is the state of the atmosphere at a moment in time, as determined by the simultaneous occurrence of several meteorological variables such as temperature, wind, cloud cover, precipitation etc., at a specific geographical location.

Climate is usually defined as ‘average weather’ for a specific location.

- Warmer temperatures alter the hydrological regime determining changes in precipitation levels and patterns, or extreme weather events.
- Expected increase of frequency and severity of climate-related natural catastrophes and the current risks of disasters of hydrogeological origin pose a serious threat to buildings, infrastructure, and physical assets located in vulnerable locations.
- The decreasing of water resources determines severe problems to both society and ecosystems; a peculiar picture of climate change emerges over the Mediterranean regions, which are characterized by higher temperatures, dry summers, and heavy rains.

IMPACTS OF CLIMATE CHANGE ON HUMAN HEALTH

- Greenhouse gases pose a danger to public health and welfare.

WHAT THE SCIENCE SHOWS?

- The new review grouped the collected information into different categories:
- public health,
- air quality,
- agriculture,
- forests,
- water resources,
- sea level rise,
- infrastructure and
- wildlife.

- The four new categories include:
  1. ocean acidification,
  2. national security,
  3. economic well-being and
  4. violence.

PROJECTED BEHAVIOURAL IMPACTS OF GLOBAL CLIMATE CHANGE

- It emanates from environmental changes including temperature elevation, extreme weather events, rising air pollution, etc.
- Negative affect, interpersonal and intergroup conflict, and possibly psychological distress increase with rising temperature.
- Droughts, floods, and severe storms diminish quality of life, elevate stress, produce psychological distress.

- Temperature is associated with quality of life.
- Recreational opportunities are compromised by extreme weather, and children may suffer delayed cognitive development.
- Increases in pollutants can concerned citizens and may accentuate psychological distress.
- Research on mental health and temperature has focused on psychopathology and quality of life.
- Both climate change and human activity are the important drivers that can change hydrological cycle routs and affect the features of hydrological drought in river basins.

CLIMATE CHANGE INTERACTIONS WITH AGRICULTURE AND FOOD SECURITY

- Globally, climate change has negative effect on crop production and decreasing food production.
- This is depending on the location and type of crop.
- Meanwhile, a negative effect in food supply could increase food price.
- This can limitless the ability of some nations to provide enough food for their population.

POPULATION

The UN Population Division projects a world population of 9 billion in 2040 and 10 billion in 2080.

As the population of the planet grows toward a projected 11 billion people by 2100, the key to producing enough food will be to find better ways to manage the agricultural lands we already have, Sparks says, rather than expanding into new areas. However, this will mean overcoming some rather daunting challenges.

- Rapidly increasing population exacerbates existing problems, such as transnational crime, economic interdependency, CLIMATE CHANGE, the spread of diseases such as HIV/AIDS and various other pandemics, and such social issues as gender equality, reproductive health, safe motherhood, human rights, emergency situations, and so much more.

- The Global Risks 2015 Report looks at four areas that face particularly daunting challenges in the face of rapid and unplanned urbanization:
  1. infrastructure,
  2. health,
  3. climate change, and
  4. social instability.
- In each of these areas we find new risks that can best be managed or, in some cases, transferred through the mechanism of insurance.

- **Food** is an essential economic, environmental and social aspect that makes a vital contribution to food supply.
- **Agricultural biosecurity** is concerned with invasive that affect the agroecosystem and food supply; and concerned with potential agroterrorism events.
- The **threats** to agricultural biosecurity have increased with the globalisation which has resulted in increased volume and food diversity and food industry.

- **Climates**, **landscapes**, and **civilizations** brings together a collection of studies on the history of complex interrelationships between **biotas** and their **environment**.
- Over the next 15 to 20 years, average **temperatures** are estimated to rise by at least 2°C, and possibly up to 4°C.
- Higher temperatures and reduced precipitation will increase the occurrence of **drought**.

- Development of a **new** agricultural biosecurity is needed to protect the food supply and industry.
- This strategy will seek to achieve by **2025** to cover the increases of world population.
- By **2080**, agricultural output could decrease by 40%.

- Biosecurity is a strategic and integrated approach that **forms** the **policy** and **regulatory** frameworks that **analyse** and **manage** risks in the sectors of **food safety**, **animal** and **plant** life and **health**, including associated **environmental risk**.

With the challenges of:

1. Climate change and
2. Growing world population

We need to ensure that:

We can feed ourselves in the following years to come by growing enough food sustainably.

Agroecosystems should produce much greater amounts of:

- **Food,**
- **Fodder,**
- **Fiber and**
- **Energy, etc.**

to meet the global needs, and:

- Improve human health and social life,
- Reduce dependence on traditional fuels,
- Adapt to climate change,
- Reduce environmental degradation and
- Decline in soil quality.

The un goals of sustainable development in 2017 should be considered for example the:

1. SDG-1 which focuses on the poverty reduction,
2. SDG-2 which focuses on food security and promotes sustainable agriculture,
3. SDG-13 specifically calls for urgent actions to combat climate change and its impacts.

About 45 of the 169 targets are related to SDG-13, which highlights the need to tackle climate change and avert its impacts, particularly on food security, water, energy, and economic development.

Security, nutritional quality and safety of food production are varying widely around the worldwide

There are several limitations in food production over the worldwide due to:

1. Contamination of the food chain and water by pesticide residues, and pest control,
2. Reduction in nutrients,
3. Climate change,
4. Increasing food and fuel prices,
5. Soil erosion, fertility loss,
6. Water pollution,
7. Biodiversity depletion and
8. Decreases in agricultural land areas used for food production.

Science will be very important to develop crops that need less water, fertilizer or chemicals.

- Novel, environmentally-friendly solutions are proposed based on:
  - agrobiotechnology,
  - gene technology,
  - nanobiotechnology,
  - molecular biology, and, etc.
- Recognizing:
  - the environmental bases,
  - self-regulating ability and agroecosystem stability,
  - agrobiodiversity,
  - climate change and global warming,
  - soil nutrients and etc.
- Reducing, reusing and reprocessing waste and offering financial incentives are our aims by 2025.

The World Commission on Environment defines sustainability as:

“A sustainable society is one that meets the needs of the present without compromising the ability of future generations to meet their own needs”.

This integration should meet to the global food requirements based on the:

1. **Total agricultural land areas,**
2. **Soil quantity and quality and**
3. **Fertility resources.**

Modern organic agriculture is an alternative parameter of food production should contain features of agroecosystems that promote the environmentally, socially and economically sound of food, fodder and fiber production.

Also, aim to optimize quality at all levels and to reduce the use agrochemicals, greenhouse gas emissions and use of natural items that enhance the balance of agroecosystems and integration components of these ecosystems.

- The modern organic agro-eco-farms, processing, distribution or consumption is to sustain and improve the process of food safety and health at all stages of the agroecosystem in order to safe the food from phytopathogens, agrochemicals and additive food staff materials.

There are many suggestions that the modern organic agroecosystems produce enough quantity and quality foods and have environmental and health advantages for consumers over food from conventional systems.

Recognizing:

- The environmental bases, self-regulating ability and ecosystem stability,
- Agrobiodiversity,
- Climate change and global warming,
- Soil nutrients and soil biology,
- Erosion,
- Non-agrochemical crop protection and
- Agroecosystem health

are the most significant environmental issues regarding to food production systems.

Food should:

- Produce, process, and distribute to feed a growing global population in ways which to:

1. use global natural resources sustainably,
2. enable the continuing provision of the benefits and services given by a healthy natural environment,
3. promote high standards of animal health and welfare, protect food safety, and
4. make a significant contribution to rural communities.

Our food security is ensured through:

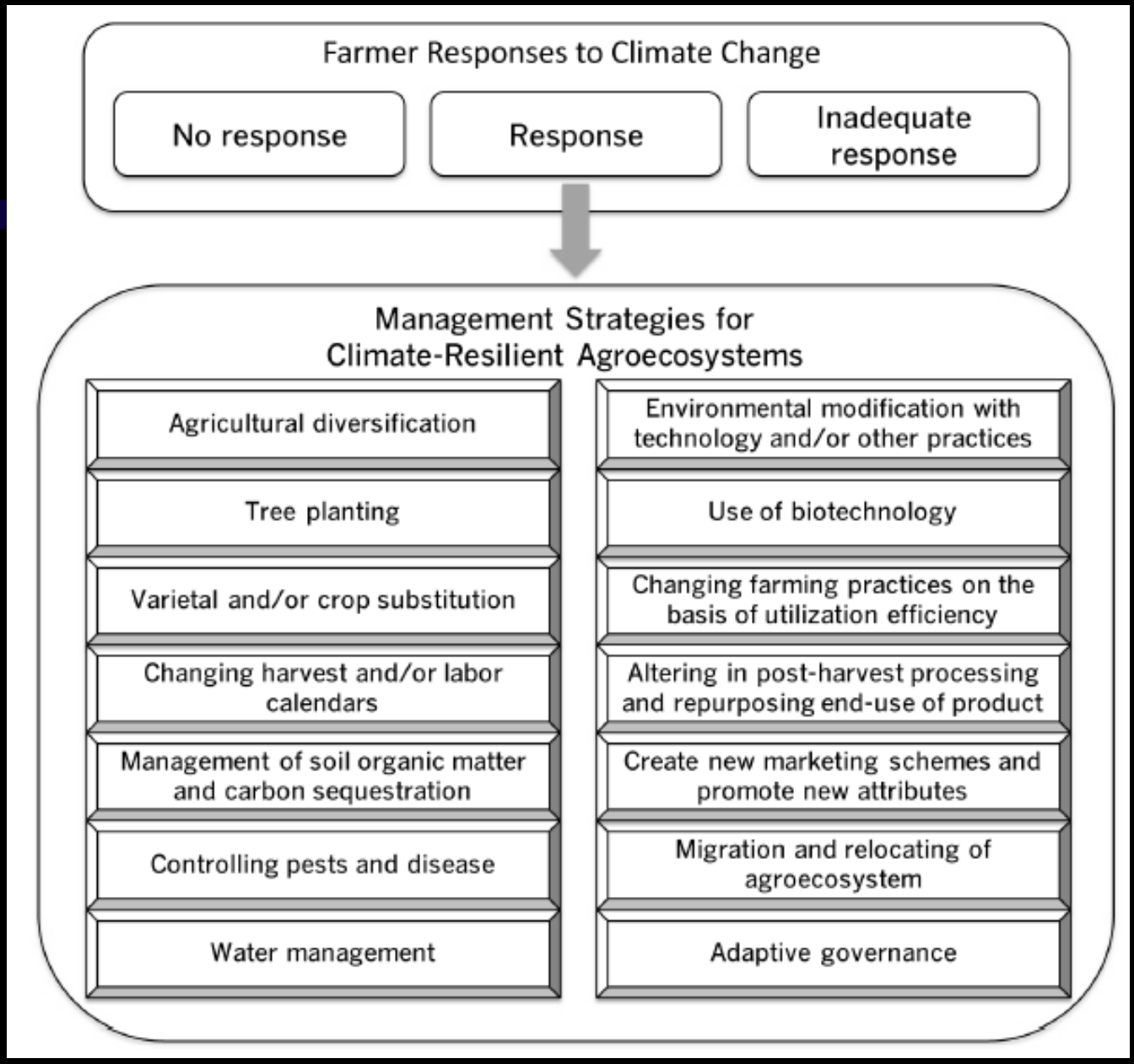
1. Strong agriculture and food sectors, and
2. International cooperation links with global partners which support developing economies.

The countries have a low carbon food system which is efficient in using resources e.g.:

1. Any waste is reused,
2. Recycled or used for energy generation.
3. Reduce emissions from agriculture by using anaerobic digestion to manage slurry,
4. Reduce nitrous oxide emissions, and
5. Generate clean energy.

- **Provide consumers with clear information on the impact of climate change on food production.**
- **Make food chain more energy efficient by providing advice, using regulation sensibly.**
- **Reducing, reusing and reprocessing waste and offering financial incentives are our aims by 2025.**

Responses to climate change towards climate-change in agroecosystems.



- Goal: Our research strategy is based on the novel concept considering extreme climatic events as abiotic factors initiating a microbial succession.
- Changes in physicochemical conditions caused by climate extremes result in mobilization of partially protected organic matter and thus, increase its availability to microbiomes.
- Resulting acceleration of microbial activity is accompanied by production of extracellular enzymes able to degrade soil organic matter, i.e. cause soil priming effect.

- The experiments foreseen in our project will enable us to obtain new information on growth rates and functional activity of soil microbiomes and to reveal the role of priming in formation and mineralization of soil organic matter under climate changes.

- The development, application, and dissemination of such a socio-ecological systems framework that focuses on climate effects on crop quality and farmer responses is a step towards prioritizing such research.
- This framework can be applied to collect evidence to inform the design of climate-change resilient food systems focused on management of crop quality and other ecosystem services towards promoting environmental and human wellbeing.

Yes, by these conditionings, our global agroecosystem is safety and "balance".

CONCLUSION

- Novel, environmentally-friendly solutions are proposed based on agricultural biotechnology, gene technology, nanobiotechnology, molecular biology, and, etc.
- The rapidly growing population and the increase in demand for food, feed, and fuel will require sustainable agronomic practices to increase agroproductivity.
- Reducing, reusing and reprocessing waste and offering financial incentives are our aims by 2025.
- Yes, by these conditionings, our global agroecosystem is safety and "balance".
- More investment is needed in agricultural research regarding to climate adaptation.

THANK YOU FOR YOUR ATTENTION!