Themes within Creative Innovation, bridging the five Science Groups within WUR

**• Animal Sciences <> Social Sciences: Ethics of responsible production & consumption**

What defines responsible production? Is it minimal exploitation of animals or minimal pollution? In any case the search for that answer and in the end the responsible production and consumption goes further than facts and figures, it includes responsibility and accountability. Not just of producers or consumers or the government, but of all.

**• Animal Sciences <> Environmental Sciences: Understanding and using evolution to increase resilience:**

Evolution is the driving force behind all biodiversity, from viruses and bacteria to plants and animals. Natural selection, one mechanism of evolution helps to ensure that organisms are well adapted to their environment. But what happens when environments change faster than their inhabitants can adapt? For millennia humans have employed artificial selection to domesticate plants and animals. Some scientists even think we can domesticate disease-causing organisms to make them harmless.

Can we harness evolutionary processes such as selection to increase resilience in the face of

accelerating global change?

• **Animal Sciences <> Agro technology & Food Sciences: Ethics & Genetics**

Currently the possibilities of genetic manipulation are increasing at a tremendous rate. This will bring scientific progress and may help to create new medicines, and crops resistant to pests and diseases. But how far can we go in this respect? Where are the boundaries, ethically speaking?

**• Animal Sciences <> Plant Sciences: Interconnectivity of plants and animals**

Animals and plants – among others – inhabit the earth and are crucial for human survival. Animals and plants are tightly linked. For example, animals depend on the oxygen fixed by plants during photosynthesis, while plants require carbon dioxide that is produced by animals. Over hundreds of millions of years of evolution animals and plants co-adjusted their physiology, their mode of reproduction, their feeding habits, their niches – an interconnection that cannot be broken. However, production systems with increased specialisation and artificial production of mineral nutrients partly decoupled the interconnectivity. How will the future look like, further decoupling or tighter coupling or just a different kind of coupling?

• **Social Sciences <> Environmental Sciences: Adaptability of cultures and ecosystems:**

Both cultures and ecosystems can adapt to changes triggered by internal and external forces. The capacity of any given culture or ecosystem to adapt, however, varies greatly and depends on its intrinsic characteristics and the nature of the forces acting on it. Some ecosystems, such as rocky intertidal areas or fire-prone landscapes, actually rely on disturbance for their very maintenance. By contrast, other ecosystems may be completely devastated or fundamentally altered by similar disturbances. The same is true for cultures: some flourish in the face of change; others disappear. An example of the interaction between the two can be found on isolated oceanic islands. Colonisation of such islands can greatly affect earlier colonisers and ecosystems that mutually adapted to each other over long periods of time. How can social and environmental scientists cooperate to help alleviate adverse environmental effects on local cultures?

**• Social Sciences <> Agro technology & Food Sciences: Dialogue of inclusion and diversity:**

It is generally assumed that diversity and inclusion should be enhanced, but what are the scientific implications of this? Do we actually understand diversity well enough to transform intentions towards inclusion and diversity into practices and numbers and sustain them. What are the barriers we are facing and how can we take them away?

**• Social Sciences <> Plant Sciences: Big data & Fake data:**

The term big data refers to our recently acquired capability to rapidly collect and store

extremely large quantities of data from all aspects of life –where we travel, whom

we meet and what/and with whom we communicate, what genetic traits we have and how

these relate to our health. Big data are stored and distributed around the world, and may present sensitive and valuable information, for example for governments, security

organizations, or healthcare providers. Manipulation or misinterpretation of big data can lead to

fake data that may have an immense and lasting impact on individuals or society. The access and ownership of these data is a delicate issue. How do we balance transparency so that our data are available and useful for other scientists, while also protecting the data collectors intellectual property and any potentially sensitive information?

**• Environmental Sciences <> Agro technology & Food Sciences: Tipping-points in system Earth:**

Both system Earth and its constituent ecosystems are normally in some form of equilibrium.

Disturbances in conditions (climate, nutrient run-off, fine dust emissions) can result in big

changes that affect species and communities. Tipping points refer to sudden, drastic changes in environmental conditions and species composition and abundances, and ultimately lead to a new equilibrium. The dynamic fluxes of energy and matter and the cycles of life and death can often be considered to be in a stable equilibrium, where losses and gains keep each other in check. Long-term or sudden disturbances can tip the fragile balances out of equilibrium, causing sudden declines in diversity, in ecosystem functioning and in the climate. Predicting when these tipping points are bound to happen is an important research theme; can we detect early warning signals for tipping points?

**• Environmental Science & Plant Sciences: Emerging system properties & Climate feedbacks:**

Plants are often considered to be rather passive organisms that make up the green parts of our planet. Do not be fooled! We normally only see their aboveground half, and not how belowground their precious roots scavenge nutrients and water to support life aboveground. In turn, leaves take up CO2 through photosynthesis and release oxygen and water to the atmosphere, processes that influence the climate. As dead leaves return to soil, nutrients in them can be recycled through decomposition and mineralization. The process of decomposition, however, also implies release of CO2 into the

atmosphere so that balances between carbon uptake through photosynthesis and carbon

release through decomposition and respiration critically depend on factors limiting plant growth

like the availability of nutrients and water. Could shifts in this balance, e.g. due to climate

change, further increased releases of CO2 en so further enhance global warming?

**• Agro technology & Food Sciences Microbiomes: Symbioses between animals or plants and microbes:**

Plants have colonized land thanks to symbiosis with fungi. With the help of bacterial symbionts, cows can degrade cellulose-rich plant material for their food supply. And termites have been able to colonize dry, hot savannahs thanks to the symbiotic fungi they cultivate, which provides them, among other things, with air-conditioning conditions. Moreover, microbiomes can be tuned to provide services in nature and society. For example, by creating the proper environmental conditions (oxygen levels, pH, nutrient concentration, temperature), microbiomes can be used to clean wastewater, to recover energy from waste, or to recover nutrients from wastewater for reuse in agriculture. Many more examples can be listed and one can wonder what are the limits to the possibilities of the uses of microbiomes?