A. Conceptual and methodological path of the research

(1) Somatic cell genetics – from cells to in vitro regeneration

- biochemistry and genetics of amino acids and nitrogen metabolism

- plant cell totipotency and nuclear organization

- haploid cell culture to generate mutant lines and whole plants

(2) Flower development and evolution

- reproduction systems and sex chromosomes (backwards evolution)

- flower morphogenesis, sexual dimorphism, and evolution

- gene transfer and cloning

(3) Flowering plants as matrix and engine of complex food systems

- biomass control and flowering time

- agriculture as an integrated soil-water-biomass system

(4) Global resources and the commons

- resources as matrix and engine of history

- resources according to planetary, societal, and time boundaries

- resources and planetary health narrative and methodology

B. I concentrate below on the Resources-Planetary Health approach, a Social-Ecological framework

Here are three concepts that contain essential methodological capacities for the socioecological approach with a systemic transformative potential.

This approach illustrates the work carried out at the Michel Serres Institute, École normale supérieure (ENS) de Lyon. It is mainly inspired or reinforced by Michel Serres' Natural Contract, Elinor Ostrom's work on resource governance systems and the Resources Management Act 1991, the supreme law of New Zealand. To this must be added new work on carrying capacity, the HANDY model (Mote et al, 2020) and the 2022 report "Earth for All – A Survival Guide for Humanity" of the Club of Rome.

Resources as a social construction of socioecological systems evolve with the cultures, organization and techniques of societies. The physical resources resulting from the cycles and functions of the Earth system are finite or exhaustible and represent the nutrients of social "ecosystems". The dynamics of this socioecological whole are translated into states of health

of environments, societies and people. They are inseparable. This is why ***the "systemic health-resources" approach aims at socioecological robustness*** as a radical change in the relationships between humans and between humans and nature.

The following references illustrate work on concepts, methods and toolboxes.

What is agriculture?

Negrutiu, I., Frohlich, M. W., & Hamant, O. (2020). Flowering plants in the Anthropocene: A political agenda. Trends in Plant Science, 25(4), 349-368. https://doi.org/10.1016/j.tplants.2019.12.008

> Soil-water-biomass – an evolutionary perspective on agriculture and biotechnology by explaining why flowering plants are the supportive architecture of the biosphere and the backbone of agro-ecosystems.

Honet, C., Negrutiu, I. (2012) De l'agriculture comme problème à l'agriculture comme solution: des plantes et des hommes. In: Le végétal saisi par le droit (Coordination Dross W), Ed. Bruylant, Bruxelles pp 7-46

Negrutiu, I., Pamfil, D. (2017) Paun Ion Otiman si agricultura: cum trebuie regandita relatia romanilor cu natura si securitatea resurselor tarii. In: Omagiu PI Otiman, Ed Academia Romana.

Anthropocène à l'école de l'indiscipline (2018) Eds Hamant O, Le Gall J, Negrutiu I. Edition du temps circulaire. https://www.lulu.com/en/en/shop/olivier-hamant/anthropocene-digest/paperback/product-1kk9rm5k.html

> Anthropocene – from excess to sobriety, rethinking food and agriculture first; Agri-food resources: global issues and tools for understanding and action.

50 years of semantic confusion and international inaction

Pincemin, B., & Negrutiu, I. (2024). Cinquante ans d'un discours institutionnel socio-écologique qui se cherche encore. The open archive HAL SHS. https://shs.hal.science/halshs-04550985

> On why systemic health is becoming the unavoidable narrative, following decades of shifting agendas (from the Stockholm Declaration, Brundtland Report, Rio conferences, United Nations Development Programme-UNDP reports and Nobel Prize Statements, and more).

The main concepts – on slow, systemic, cumulative risks

Acunzo, D. J., Escher, G., Ottersen, O. P., Whittington, J. D., Gillet, P., Stenseth, N. C., & Negrutiu, I. (2018). Framing planetary health: Arguing for resource-centred science. The Lancet Planetary Health, 2(3), e101-e102. https://doi.org/10.1016/s2542-5196(18)30023-8

The paper articulates for the first time the Planetary Health approach to the global resources stewardship.

Negrutiu, I. (2025). Aggregating Planetary Boundaries Pays off: Two Interacting Grand Stressors, Food Systems and Global Pollution, Generate the Planetary Health Bubble. In Encyclopedia of Food Systems and Agriculture (3rd ed.). In progress of publication at Elsevier.

Measuring what counts by setting the baseline on the food-pollution-waste-health nexus, while making recommendations on how to address them in a socio-ecosystemic perspective.

The systemic health concept în brief

Negrutiu, I. (2022). A compass for resource justice and planetary health: Food systems and global pollution. Resources, Conservation and Recycling, 181, 106229. https://doi.org/10.1016/j.resconrec.2022.106229

The framework for resource justice within ecological limits is the entry point for addressing other grand challenges (poverty, hunger, climate).

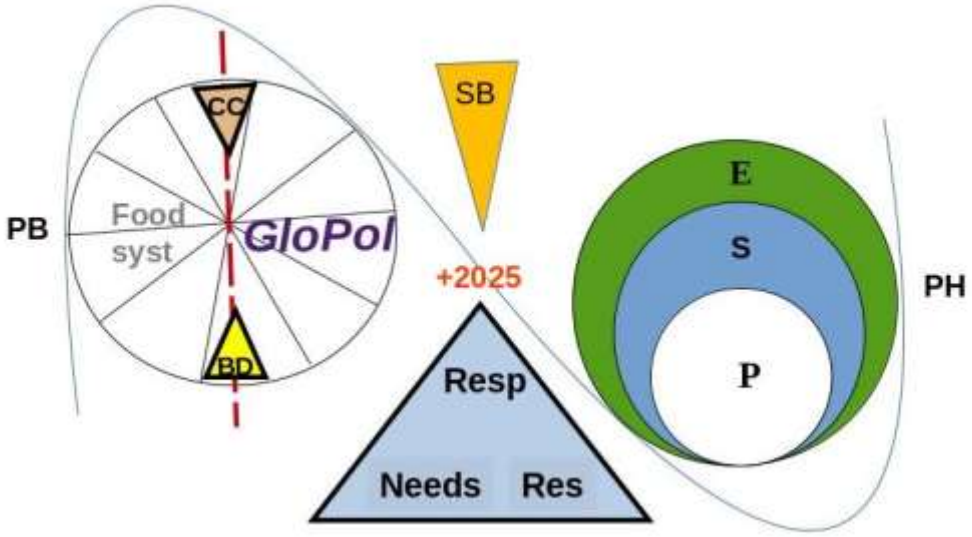
Arguello Velazquez, J. A., & Negrutiu, I. (2019). Intersecting planetary health and planetary boundaries reveals the double challenge of agriculture and global physicochemical deregulation. The Lancet Planetary Health, 3(1), e10-e11. https://doi.org/10.1016/s2542-5196(18)30235-3

Individual boundary assessment is articulated into a two component matrix: food systems and the global physico-chemical pollution.

Extended analysis of the concepts

Negrutiu, I., Escher, G., Whittington, J. D., Ottersen, O. P., Gillet, P., & Stenseth, N. C. (2023). The time boundary 2025-2030: The Global Resources and Planetary Health Toolbox. Proceedings Romanian Academy Series B, 25/2, 117-135. https://acad.ro/sectii2002/proceedingsChemistry/doc2023-2/Art.4.pdf

Humans do not frame resources properly, illustrated by predatory economic practices and poor governance across sectors and institutions. The consequence is convergence of cumulative social and planetary crises translating into state shifts defining the 2025-2030 time boundary.



The time boundary 2025–2030 framework. Planetary Boundaries (PB diagram) have been aggregated in two subsets of interacting boundaries: food system (Food Syst) and the physico-chemical (global pollution, including waste, GloPol) disruptions. Climate change (CC) and biodiversity (BD) variables overlap Food and Global Pollution system boundaries (inserts in PB). Together with Societal Boundaries (SB) as reflected in the resource landscape, they are operating under cumulative state shift regimes, e.g., resources and pollution/waste, soils and water, population and carrying capacity, land use change and per capita economic indicators (the sygmoid). The Planetary Health framework (PH diagram), the indivisible health of ecosystems (E), society (S), and people (P) imply coherent and immediate trade-offs between social and ecological health through the Responsible adjustment of Resources and Needs (Resp, Res, Needs triangle). That requires amortizing the consumed socioecological capital by making effective the real costs of commodities and labor in the global economy. Coupling resources and PH becomes a narrative and metrics of the common purpose across boundary systems. (Adapted from Negrutiu, 2022).

Negrutiu, I. (2024). Global resources and resource justice—Reframing the Socioecological Science-to-Policy Landscape. Resources, 13(9), 130. https://doi.org/10.3390/resources13090130

> The central role of resource stewardship, according to nature's physical limits, is highlighted in the context of the boundary systems for the biosphere and societies, and the carrying capacity and inclusive systemic health (One Health, Planetary Health, …). The prioritization of resource justice and responsibility becomes a societal project, embedding the economy in social and ecological frames through institutional reframing. This is supported by assessing the costs of implementation against the cost saving generated by planetary health improvements.

Practicing with resources-planetary health: the ecosystem capital health

Argüello, J., Salles, J. M., Couvet, D., Smets, B., Weber, J. L., & Negrutiu, I. (2025). The Landscape of Environmental Evaluation Methods: Measuring what Counts for Ruling What Matters. In progress of publication at Presses Universitaires de Strasbourg.

> This article seeks to categorize a range of environmental evaluation approaches wherein scholars have endeavored to encapsulate GDP within ecological limits of varying strictness. The primary objectives are to delineate their scope, compare them, and address the overarching question: Can current methodologies effectively guide decision-making processes with an ecosystem-based perspective, aiming for "no net ecosystem degradation"?

Argüello J, Weber J-L, Negrutiu I. Ecosystem natural capital accounting: The landscape approach at a territorial watershed scale. Quantitative Plant Biology. 2022;3:e24. doi:10.1017/qpb.2022.11

> On a non-monetary acounting approach of the ecological capital at watershed scale, the Rhône river basin. Discussing current limitations, with emphasis on the data issue and policies (or non-policies). Also, why the approach avoids directly assessing biodiversity and ecological services, with recommended proxis.

Legal aspects

Negrutiu, I., Escher, G., & Dutilleul, F. C. (2019). Alimentation - agriculture - territoires: Les difficultés d'un dialogue entre le droit et les sciences de la nature. Droit et société, 101(1), 87-99. https://doi.org/10.3917/drs1.101.0087

> Food systems, food democracy, agricultural exception, adjustment of resources and needs are framework principles to serve as a guide for public action. The authors show how to establish plural food systems adapted to each territory, but in connection with each other.

Taking the health-resources message to the society and the governance circles

Collart, D. F., Hamant, O., Negrutiu, I., & Riem, F. (2024). *Manifest pentru o sănătate comună*. București, Editura Academiei Române.

> A conversation between natural sciences and legal studies on why systemic health is a political narrative and an actionable instrument for the economy and society at large. An antidote to social and ecological dumping.

Negrutiu, I. (2022) https://www.larrierecour.fr/2022/08/25/pendant-la-guerre-en-ukraine-la-chine-met-la-main-sur-la-siberie/

Mosoia, C. (aprilie-mai 2024). Spiritul socio-eco-sistemic modelează viitorul. Interviu cu

Ioan Negruțiu, membru de onoare din străinătate al Academiei Române. *Știință & Tehnică*, 129, 69-71.

Science and Society - There is no society outside nature: Dealing with the widening social-ecological gap

Negrutiu, I. (13 February 2025). Questioning Artificial Intelligence on human-sensitive issues. A comparative conversation with the American Chat-GPT and the Chinese DeepSeek-r1. Institut Michel Serres. https://institutmichelserres.ens-lyon.fr/spip.php?article753&lang=fr

C. Definitions of "systemic health" – a clarification and suggested strategy

Lerner, H., & Berg, C. (2017). A comparison of three holistic approaches to health: One health, EcoHealth, and planetary health. Frontiers in Veterinary Science, 4(163). https://doi.org/10.3389/fvets.2017.00163

De Castañeda, R. R., Villers, J., Guzmán, C. A., Eslanloo, T., De Paula, N., Machalaba, C., Zinsstag, J., Utzinger, J., Flahault, A., & Bolon, I. (2023). One health and planetary health research: Leveraging differences to grow together. *The Lancet Planetary Health*, 7(2), e109-e111. https://doi.org/10.1016/s2542-5196(23)00002-5

Morand, S., Guégan, J.-F., Laurans, Y. (2020). De *One Health* à *Ecohealth*, cartographie du chantier inachevé de l'intégration des santés humaine, animale et environnementale. Iddri[i], *Décryptage* N°04/20.

The current inclusive health landscape

It consists of frameworks known as *One Health*, *Ecohealth*, *Planetary Health*, or *Global Health*. *One Health* and *Planetary Health* stand out as two competing programs in science, economy, and policy areas developed in the last decade.

Both *One Health* and *Planetary Health* present themselves as holistic and systems-based approaches, allign with SDGs and climate agendas, and ambition integrating policy, legislation, finance, sectoral activities and institutions, and coordinate capacity building, knowledge, and data spheres.

Comparing One Health and Planetary Health

The definitions and action plans they propose evolve and change over time (Lerner and Berg, 2017; de Castaneda et al, 2023).

One Health tends to be exhaustive essentially on the public health aspects (human and animal health priority area) and has recently integrated broad range environmental aspects. The program is carried out by a quadripartite cooperation between the global international organizations WHO, WOAH (animal health), FAO, and UNEP. This is a political network operating in association with governmental, financial, economic partners, civil society organizations, joint program networks, education and training activities, with national targets and priorities across sectors. For example, the 200 research networks - concentrated so far in

Europe - investigate emerging infections and novel pathogens, endemic infections and NTDs, antimicrobial resistance, and extreme weather, water, environmental degradation, food safety, and food and nutrition security.

Planetary Health has been initiated by the Lancet-Rockefeller Foundation commission and the Planetary Health Alliance is built on a strong academic network (400 universities, among which Harvard, Oxford Martin School, Western, London Scool of Hygiene and Tropical Medicine, Sydney, California, Sunway), US and Chinese Academies, but also world leaders and experts from business, government (60 countries), and civil society organizations. The program is focused on teaching and training activities, and targets several environmental and health challenges (e.g., food systems and water, global pollution, climate, human pathologies).

The comparison highlights the fact that the main dimension that is apparently ***lacking or at least is not directly addressed is the social health per se.*** **This is where our approach comes in (Manifeste pour une santé commune).**

1) The health of nature over the long term. Examples concern biosphere functions and cycles within the critical zone as matrix of ecosystem services and externalities, and food chains as energy and biomass balance systems;

(2) Social health by guaranteeing equitable access to resources, the foundation of fundamental rights and social cohesion;

(3) Human health as a state of complete physical, mental, and social well-being.

One Health at the Romanian Academy – Vision and cross-sectoral method (May 2024)

Definition *One Health*: *One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems*.

Closely linked and interdependent, the health of the environment, society and individuals constitute the conceptual and operational framework of the balance between human activities and accessible natural resources.

The opportune and timely moment for the *One Health* approach to become **a national priority** and **a coherent and transversal vision** for all academic disciplines and all sectors of economic activity. A national project.

Starting from

- *Romania's Development Strategy for the Next 20 Years*, Romanian Academy, 2015 (especially chapters 2, 3, 5, 6, 11),

- The Club of Rome 2022 Report (*Earth for All*) and the *One Health* initiative (the quadripartite Alliance made up of the World Health Organization (WHO), the World Organization of Animal Health (WOAH), the Food and Agriculture Organization (FAO) and the United Nations Environment Programme (UNEP),

- The session dedicated to the Report and the paper on the agro-rural situation in Romania presented by academician Păun Ioan Otiman, November 2023,

- The 2023 activity report presented by academician Doru Pamfil, president of the Section of Agricultural and Forestry Sciences of the Romanian Academy,

- The multidisciplinary session entitiled *Strategies, priorities and solutions in the management of primary resources in Romania* organized at the Romanian Academy on 28 October 2022,

- Meeting of the Presidium of the Romanian Academy on the establishment of the National Center *One Health*, February 2024,

- Translation into the Romanian language, in 2024, of the book *Manifeste pour une santé commune* - authors Collart Dutilleul, Hamant, Negrutiu, Riem - published in 2023, through which economic development is the real translation of the triple long-term health: of the environment, of society and of individuals,

- Organization, on 21-22 November 2024, of the *One Health* conference at the Romanian Academy and the recommendations formulated on this occasion,

The objective should be to achieve perennial articulations between the different sections of the Academy through the *One Health* initiative. The systemic approach to health can be initiated by concretizing the interdependencies between public health, nutrition and agro-rural systems.

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Resources management system reform (2023), https://environment.govt.nz/news/rm-reform-update-may-2023/

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i Institut du développement durable et des relations internationales