Innovation for the Mediterranean forest-based bioeconomy: breakthroughs, knowledge gaps and recommendations

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Outline of the presentation

1. Introduction
2. Objectives
3. Methodology
4. Results and discussion
5. Recommendations
6. Acknowledgments

1. Introduction: social/political focus towards and relevance of Mediterranean forests

- Highly dense populated with **urbanization trends, migration patterns**, **divergent interests** **expressed by different stakeholders and new social demands**

- Mountainous topography, remoteness, low accessibility
- Soil erosion and desertification trends
- Limited biomass growth (in certain sub-regions)
- **Micro- or small-size forestry companies**
- **Changing types/attitudes/values of forest owners**
- **Conservation vs production conflicts, high role of CES**
- **Landownership fragmentation**
- **Land abandonment, rewilding**

Forestry (*timber*) = complex, costly, limited investments in innovation, limited profitability, poorly competitive

Forest industries strongly depend on imports (and this is expected to growth in future also for biomasses for energy)

Forests do not significantly contribute to the national economy = low political relevance

Wild, NWFPs underestimated, not always taken into account

Non-market ecosystem services not (enough) taken into account

1. Introduction: drivers of innovation 1/2

Dominant forest-based bioeconomy discourses

(e.g. Schmidt et al. 2012, Ollikainen 2014, Kleinschmit et al. 2014, Roos and Stendahll 2015, World Bio-Economy Summit 2015, Pülzl et al. 2017, Hausknost et al. 2017, Hetemäki 2017, Lovrić et al. 2019, Hedeler et al. 2019, Mair and Stern 2017, Dietz et al. 2018, Jarre et al. 2019, Lovrić et al. 2020, Asada et al. 2020, Wolfslehner et al. 2020, Toppinen et al. 2020)

It "encompasses the **production of renewable biological resources** and their conversion into food, feed, bio-based products and bioenergy" (EC, 2012).

- **Technology-oriented and industry-driven** (biorefineries, biotechnologies, wooden-based constructions, bioenergy, high-tech/high-performance materials, green products…)
- **Digitalisation** (IT connection, remote control, blockchain, …)
- **(Others:** systems (e.g. wood cascading, value-chains)

Main drivers:

- European Technology Platforms (e.g. Toppinen et al.2020, Lovrić et al. 2020)
- European Research Area (e.g. Birch et al. 2010)
- Forest-based Sector Technology Platform and Strategic R&I Agenda (e.g. Weiss et al. 2017, Secco et al. 2018)

1. Introduction: dominant type of innovation

Technological innovation

Technological innovations comprise **new products and processes** and significant **technological changes** of products and processes.
The implementation of a ***new or significantly improved product (good or service), or process, a new marketing method****, or a new organizational method* ***in business practices, workplace organization or external relations***
(OECD, 2005: 46)


Photo by Romain Tordo on Unsplash

- It derives from the industry- and business-oriented definitions for innovation, typically applied at an enterprise level (e.g. Schumpeter 1934, 1942, Nelson and Winter 1977, Hagedoorn 1996, Śledzik 2013; e.g. Kubeczko et al. 2006 for the forest sector), interpreted as an outcome of entrepreneurial activities/behaviour (Bruyat and Julien 2001).

1. Introduction: drivers of innovation

Emerging FFBioeconomy discourses and possible future directions

(e.g. McCormick and Kautto 2013, Kleinschmit et al. 2014, Winkel et al. 2017, Martinez de Arano et al. 2018, Secco et al. 2018, Wolfslehner et al. 2020)

- broader range of ecosystem services
- citizen-science, science-stakeholders collaboration
- knowledge co-construction

https://ec.europa.eu/growth/industry/innovation/policy/social_en

Main drivers/main effects:

- The New EU policies
- Social Capital (e.g. Putnam 1993, Horlings 2012, Marquardt et al. 2012, Pisani et al. 2018, 2020)
- Social Innovation (e.g. Mulgan 2007, Murray 2010, Moulaert et al. 2013, 2017, Haxeltine et al. 2017, Bosworth et al. 2018, Melnykovych et al. 2018, Rogeljia et al. 2018, Ninjik et al. 2019, Ludvig et al. 2019, Gorriz-Mifsud et al. 2019, Sarkki et al. 2019)
- Transformative Social Innovation (e.g. Haxeltine at al. 2017, Avelino et al. 2017, 2019, Wittmayer et al. 2019)

1. Introduction: novel types of innovation

Social Innovation

Several definitions in literature: another “fuzzy” word - risk of misleading.

The **reconfiguring of social practices**, *in response to societal challenges, which seeks to enhance* **outcomes on societal well-being** *and necessarily includes the* **engagement of civil society actors**

(Polman et al. 2017 – SIMRA project Deliverable 2.1;

simra
Social Innovation in Marginalised Rural Areas

www.simra-h2020.eu

2. Objectives

1) **To identify breakthroughs and knowledge gaps in research on innovation towards a forest-based bioeconomy** transition in **Mediterranean countries, also in relation to the R&I agendas set until 2020**
2) **To formulate recommendations** and future avenues for practitioners, policymakers and researchers

forests

MDPI

Review

Innovations for the Mediterranean forest-based bioeconomy: breakthroughs, knowledge gaps and recommendations

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Abstract:

Innovation is often considered as an all-purpose answer to overcome emerging challenges and tackle wicked problems, including the development of an effective forest-based bioeconomy. The topic is regaining attention in Europe and worldwide. So far, publications around forest-based bi-

Ready for submission

3. Methodology: focus

21 Mediterranean signatory countries of the Barcelona Convention:

- Albania
- Algeria
- Bosnia and Herzegovina
- Croatia
- Cyprus
- Egypt
- France
- Greece
- Israel
- Italy
- Lebanon
- Libya
- Malta
- Monaco
- Montenegro
- Morocco
- Slovenia
- Spain
- Syrian Arab Republic
- Tunisia
- Turkey

+ 6 other countries and territories that are part of the Mediterranean bioclimatic basin:

- Bulgaria
- Jordan
- Palestine
- Portugal
- Serbia
- the former Yugoslav Republic of Macedonia

Source: State of Mediterranean Forests (FAO and Plan Bleu, 2018: 2)

3. Methodology: literature review 2/4

- Scientific papers searching in **Scopus**
- **1980-2020**
- String: *"Forest* AND innovat* AND bioeconomy (OR bio-economy OR bio-based) AND Mediterranean OR MENA"*
  (+ run for each single country).
- In **Title, Abstract and Key Words** of papers, in **English**

- Screening based on Abstracts reading => full contents reading
- **Qualitative content analysis: traditional "narrative review"**
- **Network analysis (software: Gephi)**
- Simple descriptive statistics (Excel)

3. Methodology: literature review 3/4

- 214 papers initially retrieved
- Inclusion/exclusion criteria:
  - Excluded: those not relevant after the Abstracts' screening
  - **Excluded: papers mentioning innovation only as a general recommendation**; papers with full text not available (e.g. conference papers)
  - Included: only papers explicitly exploring innovations in forest-related fields
  - Duplicates: deleted
- **86 papers included in the review**
- Results organized according to innovation types and innovation topic
- **Confronting R&I agendas and scientific papers** (tables)

3. Methodology: analysis of R&I agendas 4/4

*Suggested **correspondences between the MFRA 2010-2020 and the DGAgri 2018-2020** agendas for Research and Innovation* (source: own elaboration)

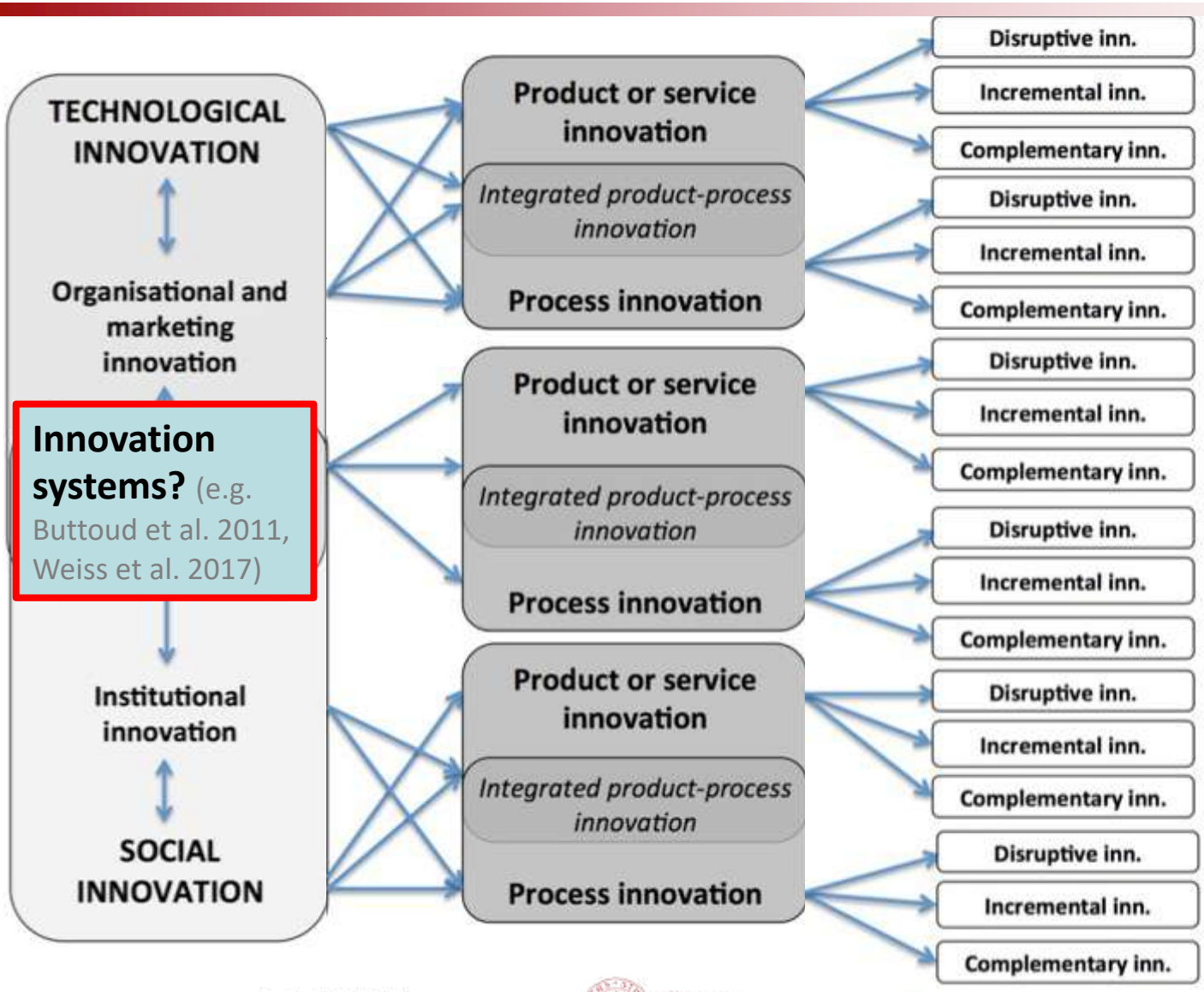
ANNEX 1

Table a)

Table b) P

MFRA 2010-2020		DGAGRI R&I agenda 2018-2020
SRA Strategic Objectives	**Forestry-based value chains**	**Priorities (P) and Cross-cutting issues (CCI)**
1. Development of innovative products for changing markets and customer needs	1-6: Commercialising soft forest values	P1. Resource management
3. Enhancing the availability and use of forest biomass for products and energy	3-1: Trees for the future	P2. Healthier plants and animals
4. Meeting the multifunctional demands on forest resources and their sustainable management	4-1: Forests for multiple needs	P3. Integrated ecological approaches from farm to landscape level
		P4. New openings for rural growth
		P2. Healthier plants and animals
		CCI1. Systems approach
	4-2: Advancing knowledge on forest ecosystems	P3. Integrated ecological approaches from farm to landscape level
	4-3: Adapting forestry to climate change	P3. Integrated ecological approaches from farm to landscape level
		P2. Healthier plants and animals
5. The sector in a societal perspective	5-2: Instruments for good forest-sector governance	CC1. Systems approach
		CC2. Social engagement
	5-3: Citizens' perceptions	CC2. Social engagement
		P5. Socio-economic research

3. Methodology: a framework to guide the understanding/classification of innovations



(Source: Secco et al. – submitted)

Types, scopes and levels of innovation and their possible interconnections

4. Results and discussion: by type of innovation 1/7

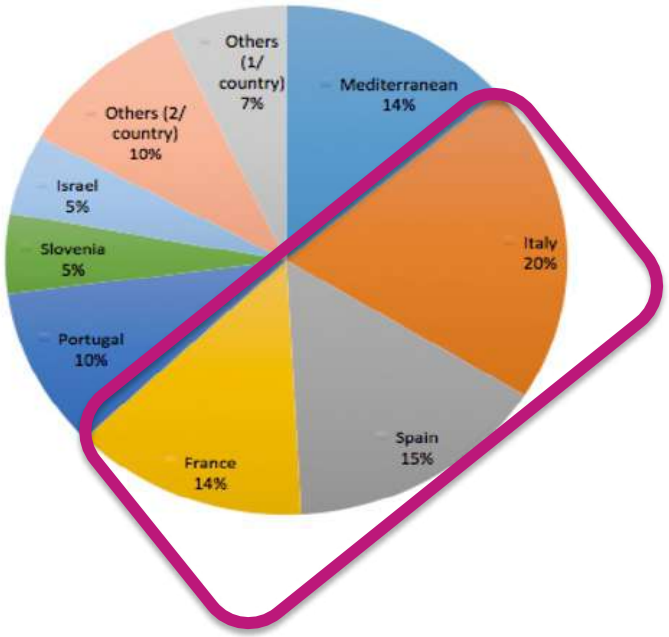
Type	Dominant topics	Other topics	Examples
Technological /technical innovation	• **Cultivation/harvesting techniques and/or machineries** • **New research approaches, methods and tools** = new models, new conceptual frameworks (e.g. forest fires prediction, erosion risk mapping, scenarios modelling, etc.)	• Agroforestry and forest management systems • Mulching and groundcover protection techniques in plantations • Digital technology in recreation management • Artificial intelligence in prediction relations between tree diameter/height	Pari et al. 2013, Schweier et al. 2019, Bados et al. 2016, Štěrbová et al. 2019; Morhart et al. 2014; Coello et al. 2018; Vitone et al. 2016; Kalabokidis et al. 2012; Zdruli et al. 2016; Azul et al. 2014; Esteban and Carrasco, 2011; etc.
Institutional/organisational innovation	• **Networks private-public actors** • Private forest owners • Marketing/technical innovations as barriers to institutional innovation	• Role of EU LEADER funded projects • Effects of international regimes • Effects of policy reforms • Intermediary organizations	Favero et al. 2016 ; Aubert et al. 2009; Mendes et al. 2011; Feliciano et al. 2011; Fromond et al. 2009; Buttoud et al. 2011; Eid and Haller, 2018; etc.
Social innovation	• **Social capital** • New forms of cooperation, relationships • Policy framework conditions	• New values • Entrepreneurial skills • New uses of forests (human health and wellbeing) • Rediscovery traditions	Blanc et al. 2012; Focacci et al. 2018; Paletto et al. 2012; Sarkki et al. 2019; Živojinović et al. 2019; Lorber and Žiberna, 2017; Daly-Hassen et al., 2010; Górriz-Mifsud et al. 2019; Rogeljia et al. 2018; Ninijk et al. 2019

4. Results and discussion: by innovation topics 2/7

Innovation topic	Predominant topics	Other topics	Examples of papers
Forestry industry (green-niche innovations)	• **Cork industry, cork-based new products and applications** • Timber products eco-innovation (constructions) • Biochemical products	• Role of the regional innovation systems for forest industry in 5 Mediterranean regions • New (or rediscovered) wood-based products (charcol)	Alfranca et al. 2009; Mestre and Vogtlander 2013; Sierra-Pérez et al. 2015, 2018; Mirabella et al. 2014, Weiss et al. 2017; Yilmaz and Basoglu, 2012; Bélis-Bergouignan and Levy 2010
Wild, non wood forest products	• **(Cork)** • Herbal tea packaging, wild mushroom, wooden knots for climbing • Truffles	• Chestnut forests management for truffle production • Argan oil boom	Živojinović et al. 2017; Michon, 2011; Aumeeruddy-Thomas et al. 2012; Maso et al. 2011
Others	• **New forest ecosystem services** (tourism and recreation) • Education programs	• Training needs for employees and entrepreneurships • Model Forests • Influencing discourses through dissemination	Notaro et al., 2012; Lingua et al. 2019; Çakir and Özdemir, 2013; Guerrera et al. 2012 Sanz-Hernández et al. 2020

4. Results and discussion

- **Ca. 35% of the papers in 2020**
- **Unbalanced distribution**: a few dominant countries **(Italy, France, Spain)** by far, followed by Portugal, Slovenia, Turkey, Greece, Croatia (Morocco, Serbia, Macedonia, Israel).



4. Results and discussion

- **Unbalanced distribution**: a few dominant countries **(Italy, France, Spain)** by far, followed by Portugal, Slovenia, Turkey, Greece, Croatia (Morocco, Serbia, Macedonia, Israel).

It confirms Bajocco et al. 2013, Di Matteo et al. 2015, Nardi et al. 2016

- Most of the papers derived from **public-funded research**, in particular EU programs (H2020, Era-net)

Leadership by the top-three countries is expected to persist in the near future (Lovrić et al. 2020), as the **level of competition for international and EU funding calls will increase** and the most structured countries and research groups will probably continue to prevail

- **Systematic, regular and long-term research** on clearly defined topics **is not often performed**

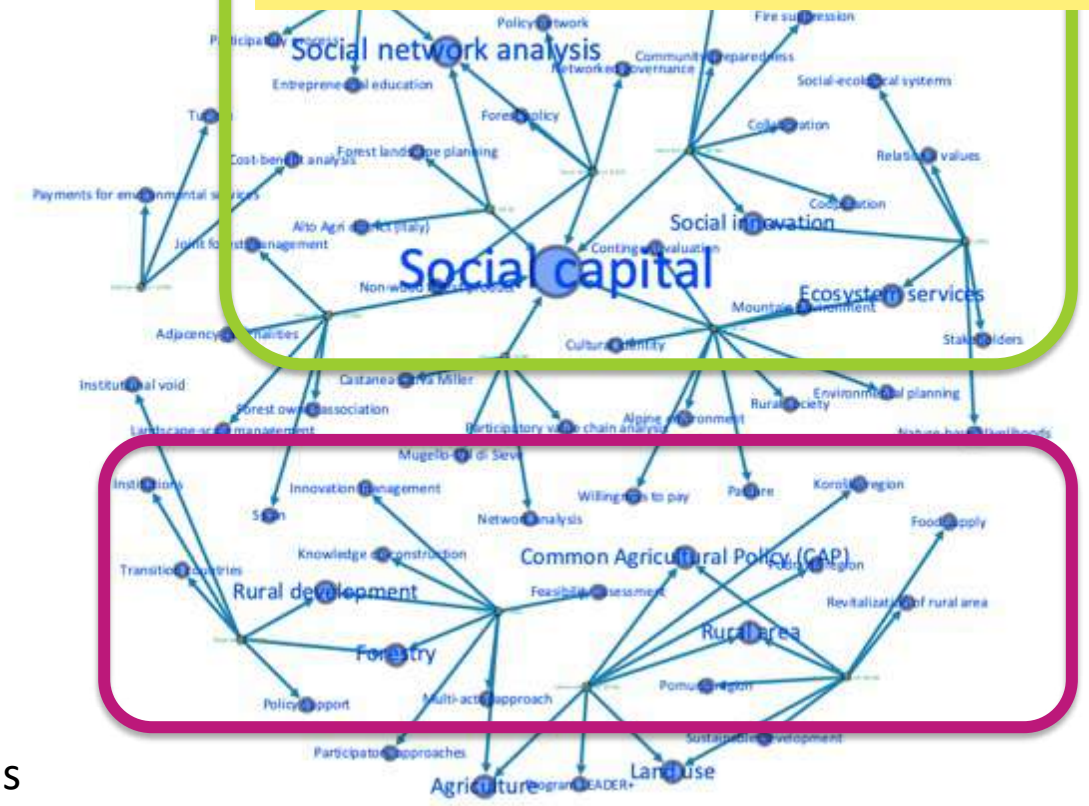
- **Effects of the Recovery & Resilience Funds?**
- **Private funds?**
- **Long-term, stable funds?**
- **Innovative funding mechanisms?**

4. Results and discussion

- **High fragmentation**

An example of the **network of concepts** explored in relation to **forest innovation and social capital**
(source: own elaboration)

It confirms that **organizational innovations are needed to reinforce collaboration among research structures** and groups/countries, to optimize resources at a regional level (Bajocco et al. 2013; Di Matteo et al. 2015)



Papers: 13
Small green nodes: Authors
Blue nodes: **keywords** identified by the Authors
Edges: connections between papers based on the keywords

4. Results and discussion

Topics and contents that remain overlooked with respect to potential and expressed needs:

- **Digitalisation and ICT, e-marketing tools and value-chains**
- **Prevention/management of hazards/risks other than forest fires** (soil erosion, water scarcity, e.g. windstorms)
- **Adaptation** to climate change, **biodiversity** and **nature-based solutions**
- **Product innovations** for typical Med. NWFPs other than cork (e.g. resins)
- **Role of NWFPs, ecotourism and socially innovative activities in rural areas** (income diversification, consolidation,)
- **Institutional innovations** (e.g. hybrid-actors, novel risks insurances, financial and contractual mechanisms)
- **Role and co-design of effective innovation systems** (sectorial, regional)
- Innovations of **micro- and small-scale forest-related enterprises**
- **Impacts of forest-related policy and governance reforms**
- **Role of forests in new social demands/uses** (e.g. human health)
- **Citizens' engagement** in forest-related sciences
- **Use of research outputs** by policymakers and practitioners
- Others (e.g. training needs of public and private actors)

4. Results and discussion: R&I gaps

MFRA 2010-2020		DGAGRI R&I agenda 2018-2020
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5. Recommendations to research 1/5

- Increase the adoption of **transformative transdisciplinary solution-oriented research** approaches **able to generate impacts** (e.g. action-research, knowledge co-creation processes) (e.g. Schneider et al. 2019)

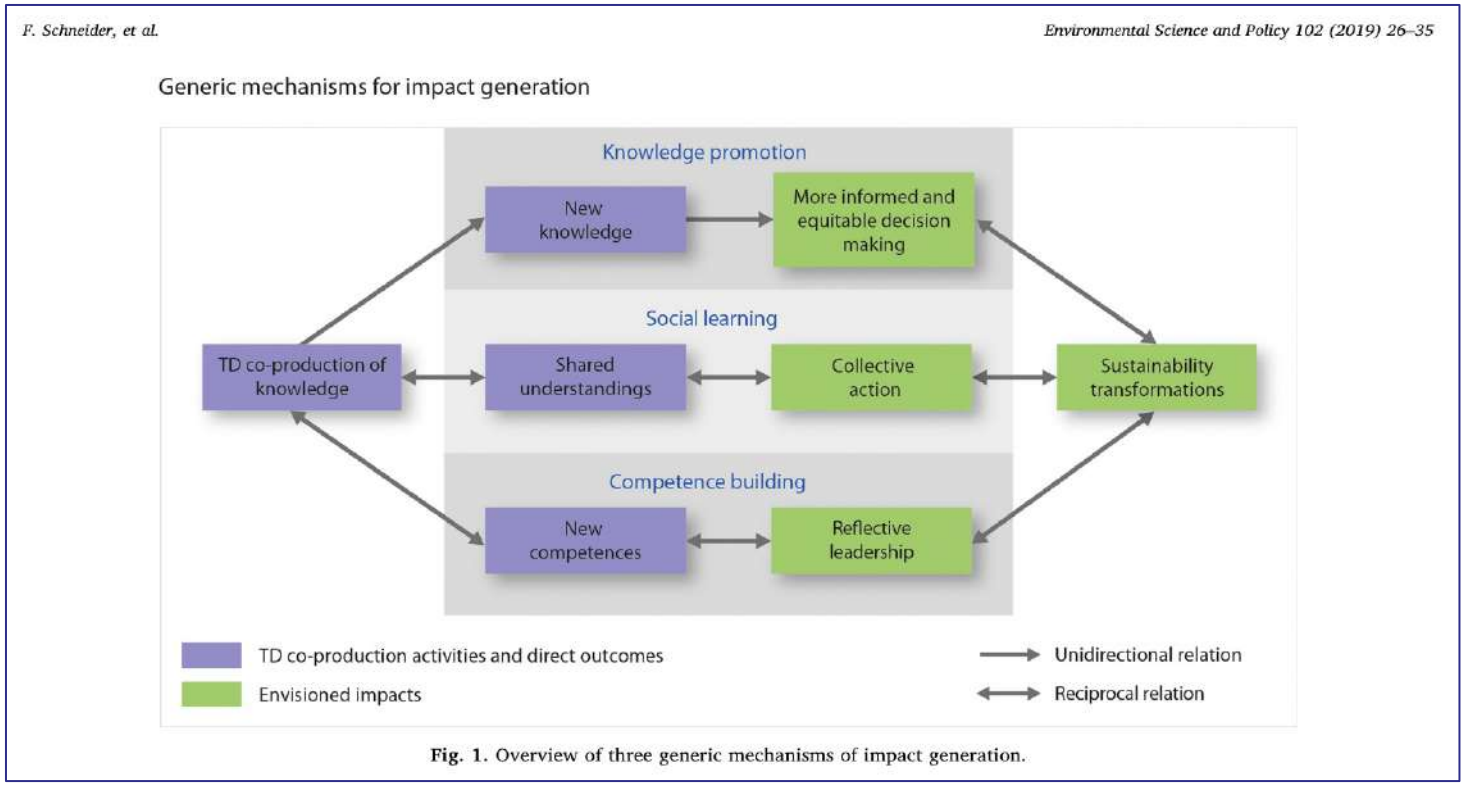


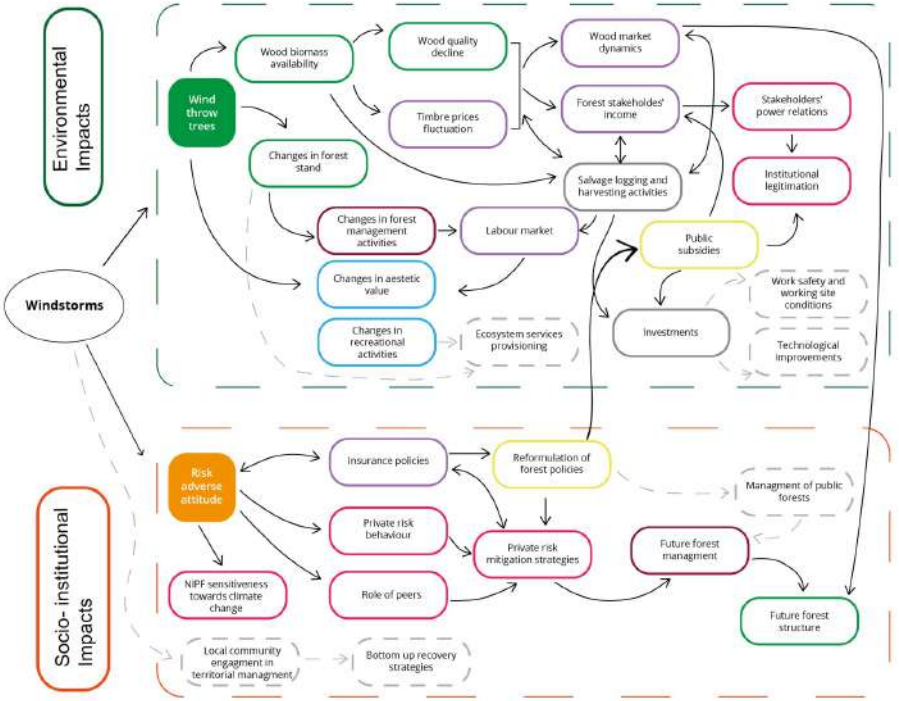
Fig. 1. Overview of three generic mechanisms of impact generation.

Source: https://www.sciencedirect.com/science/article/pii/S1462901119303867

5. Recommendations to research

- *Increase the adoption of transformative transdisciplinary research approaches (e.g. action-research, knowledge co-creation processes)*

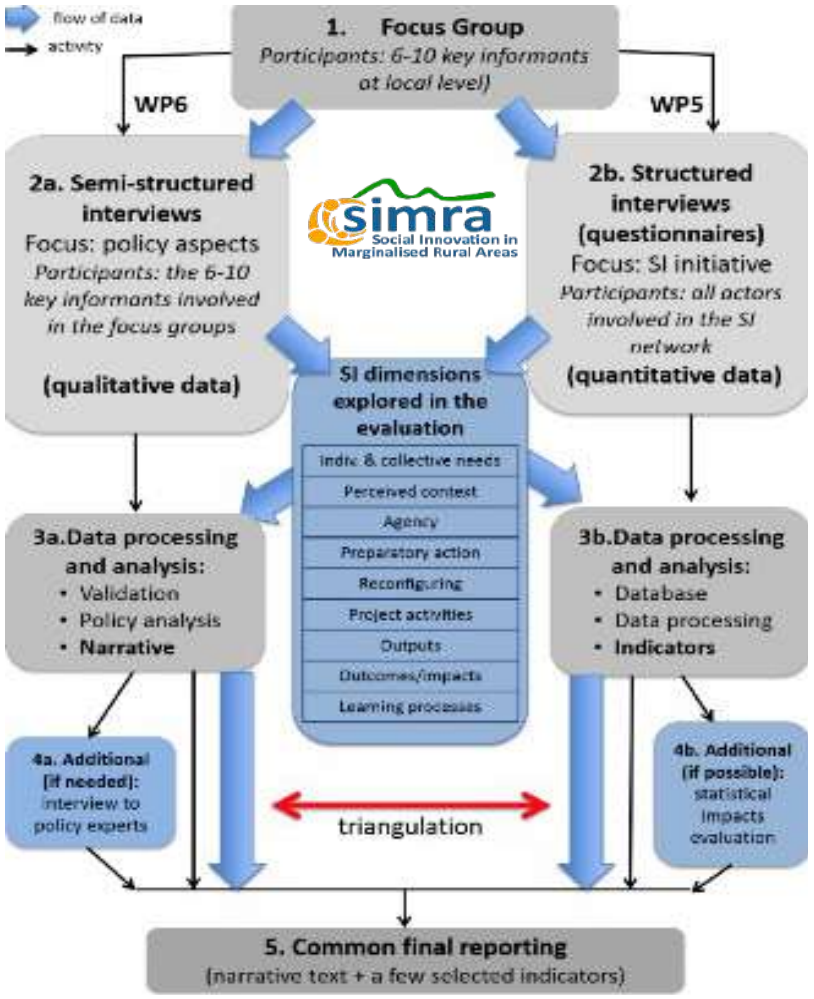
- Shift from silos- to **system thinking/system dynamics** (e.g. from linear cause-effects analysis to more holistic understanding of the drivers-consequences of actions)



(Source: Romagnoli et al. – in press)

5. Recommendations to research

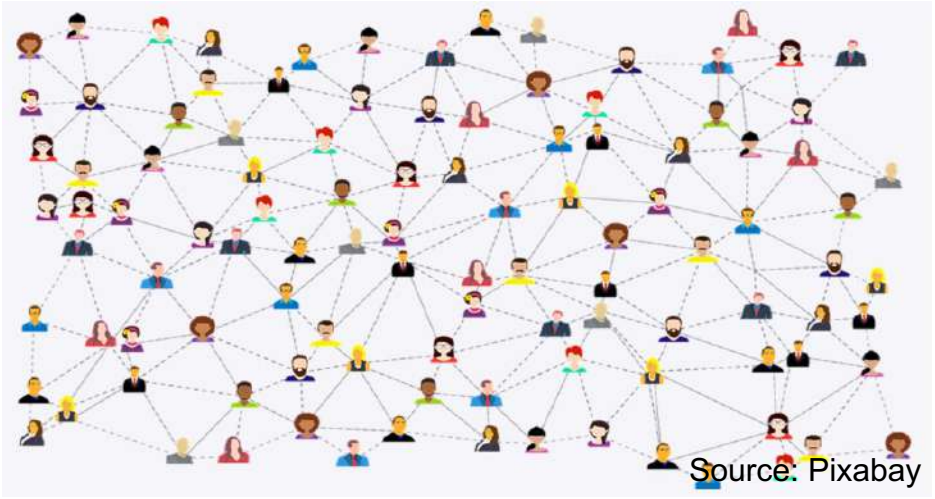
- *Increase the adoption of transformative transdisciplinary research approaches (e.g. action-research, knowledge co-creation processes)*
- *Shift from silos- to system thinking (e.g. from linear cause-effects analysis to more holistic understanding of the drivers-consequences of actions)*
- Apply **mixed methods (quanti-qualitative research, triangulation)** (e.g. quantitative indicators to overview, qualitative narrative to deepen, triangulation to validate)



Source: Secco et al. 2019

5. Recommendations to research

- Increase the adoption of transformative transdisciplinary research approaches (e.g. action-research, knowledge co-creation processes)
- Shift from silos- to system thinking (e.g. from linear cause-effects analysis to more holistic understanding of the drivers-consequences of actions)
- Prefer mixed methods (quanti-qualitative research, triangulation) (e.g. quantitative indicators to overview, qualitative narrative to deepen, triangulation to validate)
- **Improve communication capacity and skills**, invest in dissemination and work to reinforce **cross-country/institutions education/training/networking programs**



Source: Pixabay

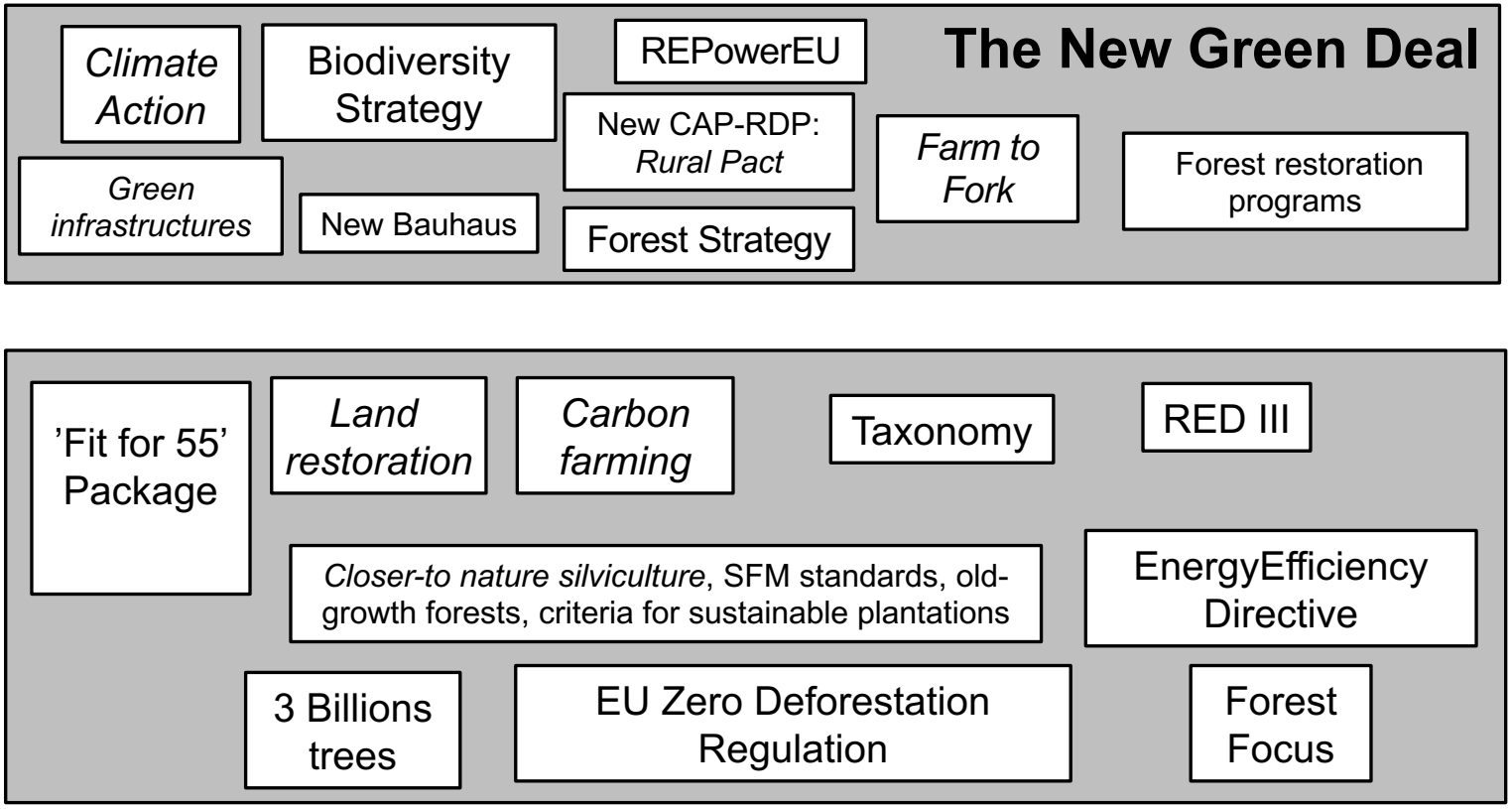
5. Recommendations to research 5/5

- Increase the adoption of transformative transdisciplinary research approaches (e.g. action-research, knowledge co-creation processes)
- Shift from silos- to system thinking (e.g. from linear cause-effects analysis to more holistic understanding of the drivers-consequences of actions)
- Prefer mixed methods (quanti-qualitative research, triangulation) (e.g. quantitative indicators to overview, qualitative narrative to deepen, triangulation to validate)
- Improve communication capacity and skills, invest in dissemination and work to reinforce cross-country/institutions education/training/networking programs
- **Choose need-driven rather** than interest-driven research topics (e.g. remain open to societal needs, get inspired by research agendas, *manage just-in-time reactions*)

5. Recommendations to policymakers 1/1

- **Broaden the concept of bioeconomy** (not only technological-oriented)
- Support the enlargement of the scope of the existing information and **monitoring systems to micro- and small-scale enterprises**
- Include **new types of beneficiaries** (e.g. not only professional forestry companies/farmers) and adjust/simplify procedures of funding programs
- Increase the **stability of funds** allocated to strategic topics, to allow long-term researches (not only 3-4 years projects), and **balance funds distribution between countries and topics**
- Support **co-creation processes** (trust, SC), **capacity building in public forest administrations** (training, updating), small-scale, networked private initiatives and **collaborative high education programs** (e.g. *Virtual Exchange programs?*)
- Support and value also **frugal innovations**
- Value dissemination and technology transfer efforts for academic carriers, non only high ranked scientific publications, Open Access

6. Conclusions: new challenges/discourses 1/3



6. Conclusions: new challenges/discourses 2/3

The global pandemic, the *One Health approach*

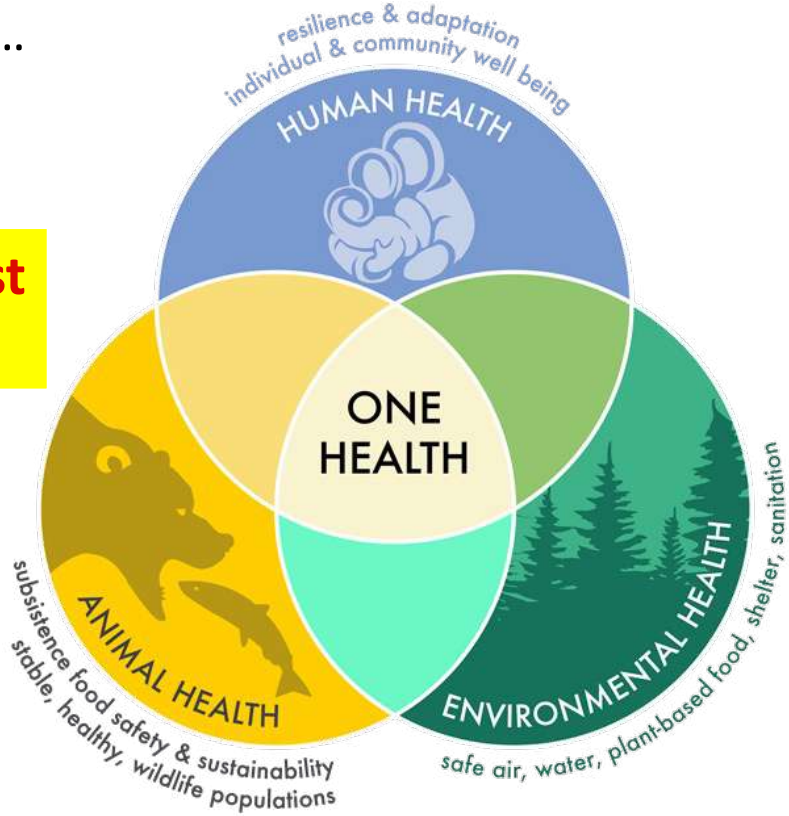
All the other trends/dynamics: forest fires, bark beetles and other hazards, droughts, extreme climatic events…

Photo by Daniel Sessler on Unsplash

Photo by Pixabay

The energy crises (forest biomasses)?

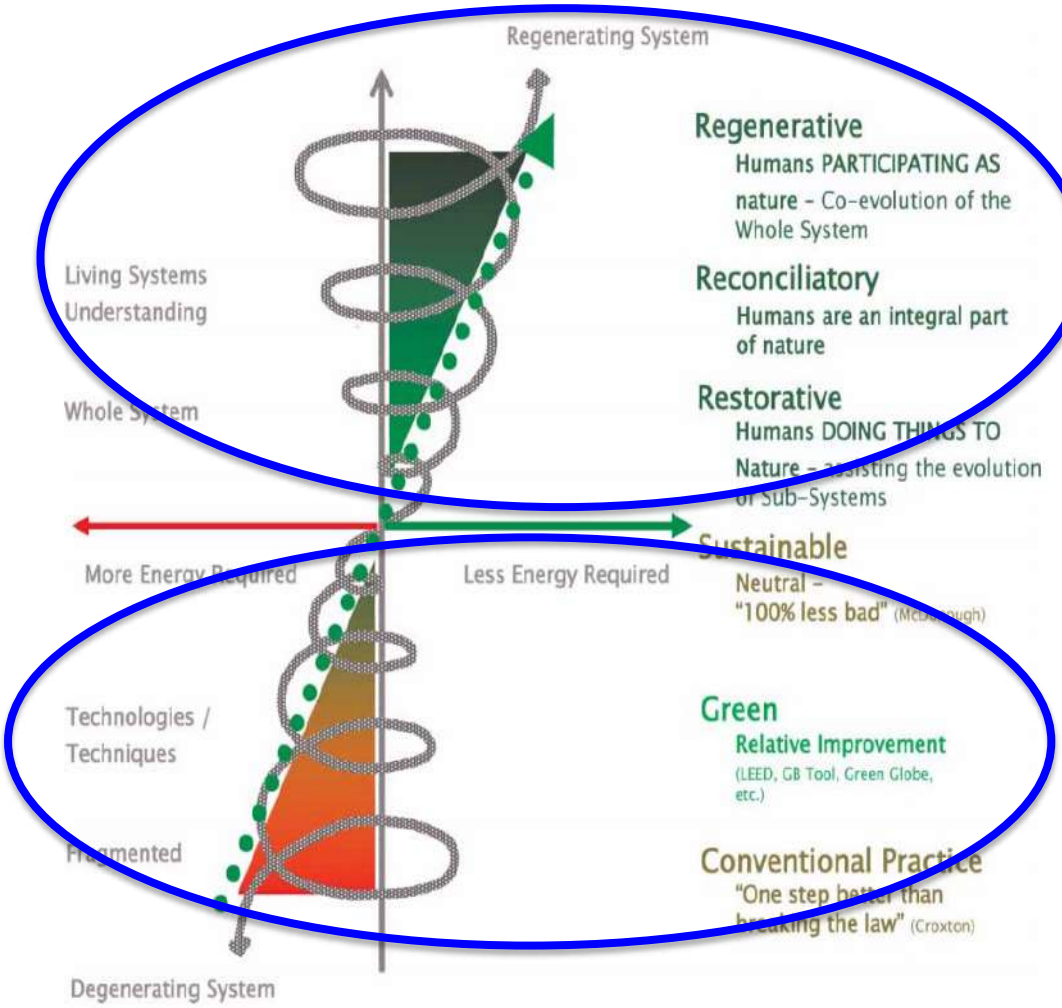
Photo by L. Secco, 2022Italy.



Source: World Health Organisation, 2021

6. Conclusions: new challenges/discourses 3/3

Are we not <u>now</u> in an urgent need to apply research approaches and policy instruments that enable sustainability transformations?



Source: Reed, 2007 – p. 661

9. Acknowledgments

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