FORESTE PER IL FUTURO
XIV Congresso Nazionale SISEF
Padova, 9-12 Settembre 2024

SISEF

A model for the Italian forestry sector: methodological approach and preliminary results

Muhammad Tayyab Khan, Davide Pettenella,
Paola Gatto, Mauro Masiero
Nicola Andrighetto, Andrea Rizzi

Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani

GRINS FOUNDATION
Spoke 6
Politiche di riduzione della CO_2

1

Outline

1. Objectives
2. Data sources
3. Model structure
4. Methodological aspects
5. Some preliminary results

TESAF Dipartimento Territorio e Sistemi Agro-Forestali
Università degli Studi di Padova

2

1. Objectives

Developing a comprehensive dynamic **Material Flow Analysis** (MFA) model to:

- to better catch the **hidden flows** of (low quality) wood material
- describe the **different value chains**, with special attention to the new ones linked to bioeconomy development
- to carry on **scenario analysis** to simulate policy development connected to:
  - the role of **wood in the bioeconomy** (construction sector)
  - **carbon sequestration** in forest and wood products
  - **carbon substitution** (bioenergy)

The MFA will be the basis for an dynamic **economic model.**

2. Data sources

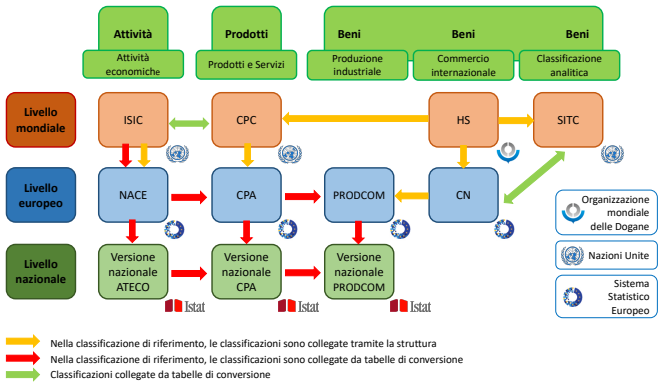
Primary sources:

- FAOSTAT (FAO)
- Eurostat (European Commission)
- Italian Forest and Carbon Inventory (INFC-2015 for base year 2018).

Additional sources:

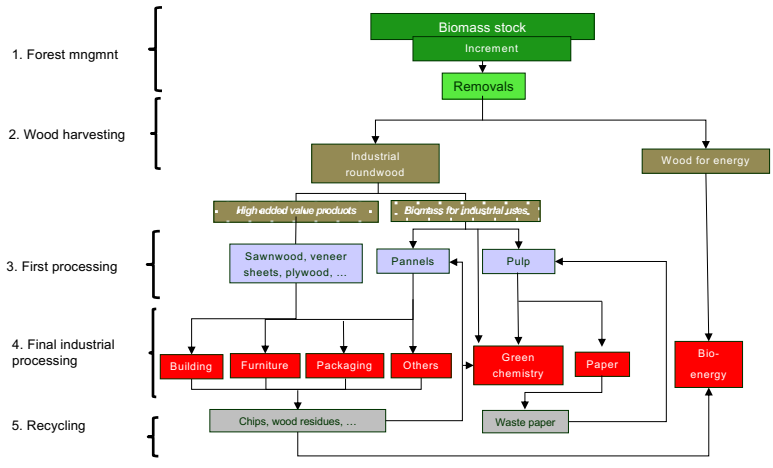
- ISTAT for economic data
- ORBIS DB
- Primary data:
  - Sawnmills: survey
  - Shadow flows, technical coefficients and consumption distribution: Delphi approach

Data sources: different classifications



- A hew aggregation of variables and a new classification with **7 final sectors**: Building, Furniture, Packaging, Paper, Bioeconomy new products (“Green chemistry”), Bioenergy, Others.

3. Model structure



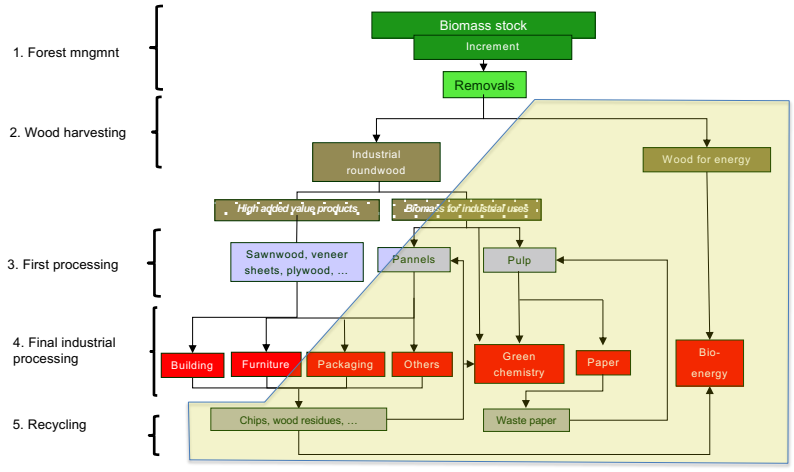
Production and trade of wood products (1,000 m3 or t; 2022)

		Fattore conversione	Import	Import. (m3 eq.)	Export	Export (m3 eq)	Produzione	Produzione (m3 eq)	Consumo apparente	Tasso di autoappr.
Legna da ardere, conifere	m3	*1,00*		82		24		1.180	1.238	95,3%
Legna da ardere, latifoglie	m3	*1,00*		459		18			10.100	95,6%
Tondame industriale, conifere	m3	*1,00*		841		416		4.125	4.550	90,6%
Tondame industriale, latifoglie	m3	*1,00*		2.228		149			2.956	29,7%
Legno grezzo, conifere	m3	*1,00*		923		440		5.305	5.788	91,7%
Legno grezzo, latifoglie	m3	*1,00*		2.687		167		10.536	13.056	80,7%
Totale legname grezzo				**3.610**		**607**		**15.841**	**18.844**	**84,1%**
Carbone da legna	t	*6,00*	57	340	1	6	10	60	115	52,0%
Cippato e legname in particelle	m3	*2,43*	559	1.358	678	1.647	3.600	8.748	8.629	101,4%
Pellet di legno	t	*2,19*	1.916	4.195	7	15	450	986	2.894	34,1%
Altri agglomerati a fini energetici	t	*1,83*	151	277	7	13	20	37	181	20,2%
Segati di conifere	m3	*1,82*	5.243	9.543	193	351	400	728	5.778	12,6%
Segati di latifoglie									1.436	67,9%
Tranciati									433	48,4%
Compensati									566	107,7%
Pannelli di particelle									851	47,9%
OSB									420	40,0%
Pannelli ad alta densità									289	8,7%
MDF									2.513	68,3%
Altri pannelli di fibra									83	4,6%
Paste meccaniche e semichimiche									725	76,9%
Paste chimiche	t	*4,46*	3.352	14.949	278	1.238	13	58	3.132	1,9%
Totale parziale semilavorati legno				**39.112**	**0**	**6.705**	**0**	**15.290**	**28.047**	**54,5%**
Carta da macero	t	*1,19*	296	352	1.481	1.762	5.394	6.419	5.008	128,2%
Prodotti legnosi riciclati	t	*2,37*	525	1.245	24	56	1.717	4.069	5.258	77,4%
Totale prodotti legnosi riciclati				**1.597**		**1.818**		**10.488**	**10.267**	**102,2%**

Recycling is 2 times the domestic removals of industrial roundwood

Fonte: dati FAOSTAT, salvo la produzione di Prodotti legnosi riciclati (fonte: Rilegno)

The relevant role of products from low-quality wood raw material



The relevant role of products from low-quality wood raw material

		Fattore conversione	Import	Import. (m3 eq.)	Export	Export (m3 eq)	Produzione	Produzione (m3 eq)	Consumo apparente	Tasso di autoappr.
Legna da ardere, conifere	m3	*1,00*		82		24		1.162	1.238	95,3%
Legna da ardere, latifoglie	m3	*1,00*		459		18		9.659	10.100	95,6%
Tondame industriale, conifere	m3	*1,00*		841		416		4.125	4.550	90,6%
Tondame industriale, latifoglie	m3	*1,00*		2.228		149		877	2.956	29,7%
Legno grezzo, conifere	m3	*1,00*		923		440		5.305	5.788	91,7%
Legno grezzo, latifoglie	m3	*1,00*		2.687		167		10.536	13.056	80,7%
Totale legname grezzo				**3.610**		**607**		**15.844**	**18.844**	**84,1%**
Carbone da legna								8	115	52,0%
Cippato e legname in p								8.741	8.629	101,4%
Pellet di legno								986	2.894	34,1%
Altri agglomerati a fini e								37		20,2%
Segati di conifere								728	5.778	12,6%
Segati di latifoglie								975	1.436	67,9%
Tranciati								209		48,4%
Compensati								610	566	107,7%
Pannelli di particelle								403	851	47,9%
OSB								168	420	40,0%
Pannelli ad alta densità	m3	*1,60*	283	453	19	30	16	25	289	8,7%
MDF	m3	*2,12*	1.065	2.258	269	571	816	1.731	2.513	68,3%
Altri pannelli di fibra	m3	*1,54*	85	131	6	9	3	4	83	4,6%
Paste meccaniche e semichimiche	t	*2,66*	182	485	15	40	240	637		76,9%
Paste chimiche	t	*4,46*	3.352	14.949	278	1.238	13	58	3.132	1,9%
Totale parziale semilavorati legno				**39.112**	**0**	**6.705**	**0**	**15.281**	**28.047**	**54,5%**
Carta da macero	t	*1,19*	296	352	1.481	1.762	3.394	6.411	5.008	128,2%
Prodotti legnosi riciclati	t	*2,37*	525	1.245	24	56	1.771	4.069	5.258	77,4%
Totale prodotti legnosi riciclati				**1.597**		**1.818**		**10.481**	**10.267**	**102,2%**

79.1% of the apparent consumption of semifinished products and bioenergy is based on low quality biomass

Source: FAOSTAT and Rilegno

9

4. Methodological aspects (seg.)

Sawmill survey

Sources of data on presence, real economic activities and location:

- ORBIS DB (balance sheet register of industrial companies)
- Data from local Clusters or institutions (Progetto legno CCIAA Trento, Cluster Friuli, Consorzio Legno Veneto, …)

Data Quality control:

- Web sites
- Control with satellite images
- Telephone calls and interviews

Wood processing capacities assessment

- from local Clusters or institutions
- From balance sheet accounts

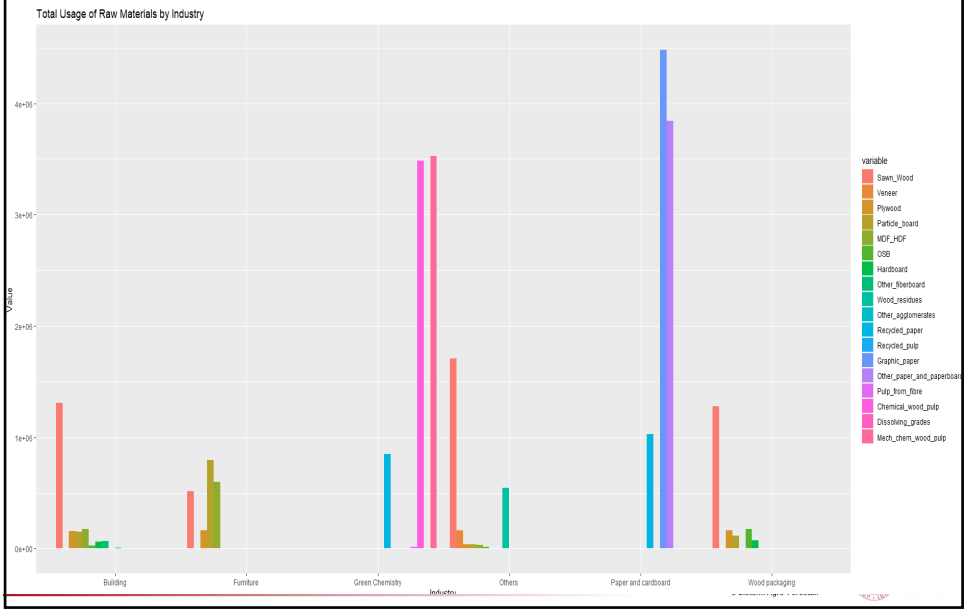
10

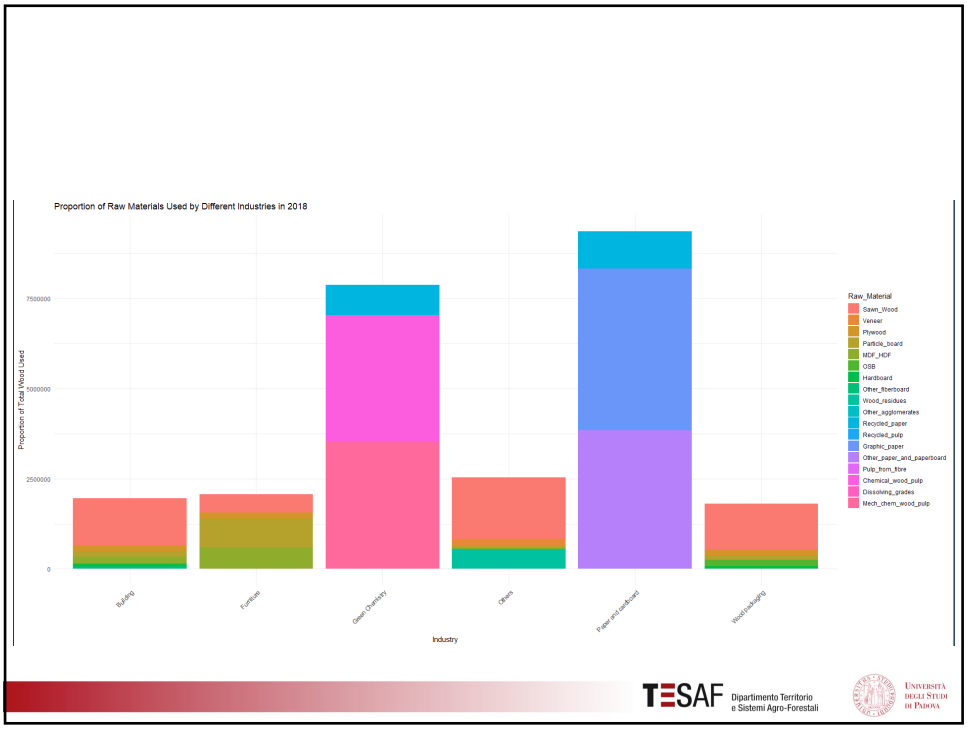
System Dynamic Modeling

- We use **Vensim Software** for system dynamic modeling
- Based on the distribution of different products, we will create a **factorial distribution of flows**, controlling the coefficients throughout the framework of the model
- For each set of flows from one process to another, we will create **adjustment coefficients** based on conditional statements (if and else)

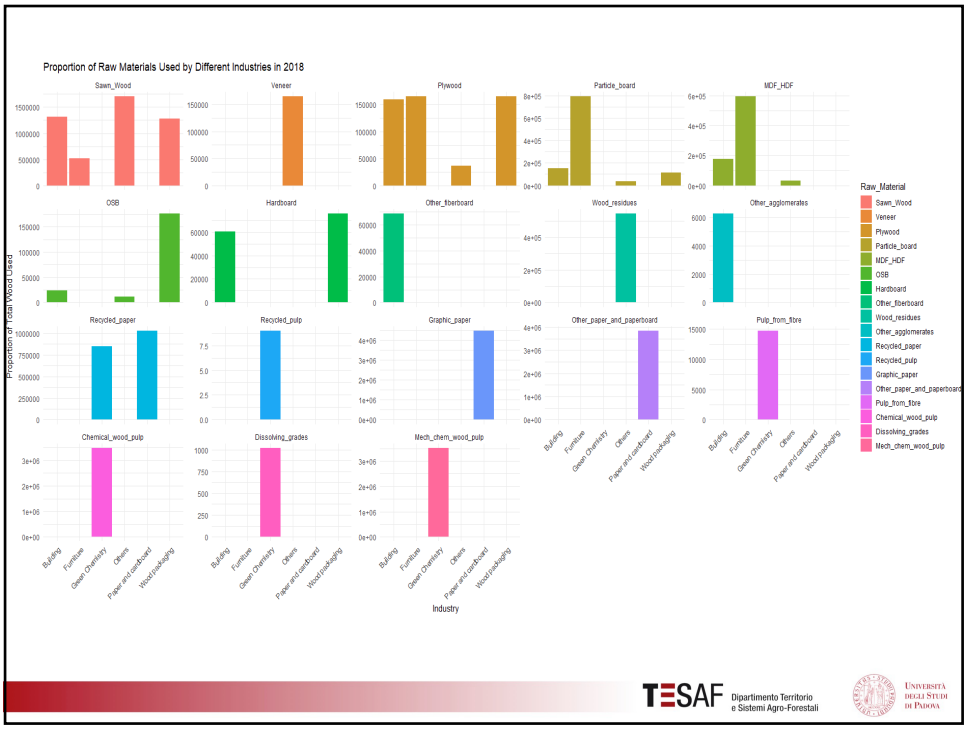
5. Preliminary results

Some examples




Proportion of Raw Materials Used by Different Industries in 2018
Proportion of Total Wood Used
Industry
Building
Furniture
Green Chemistry
Others
Paper and cardboard
Wood packaging
Raw_Material
Sawn_Wood
Veneer
Plywood
Particle_board
MDF_HDF
OSB
Hardboard
Other_fiberboard
Wood_residues
Other_agglomerates
Recycled_paper
Recycled_pulp
Graphic_paper
Other_paper_and_paperboard
Pulp_from_fibre
Chemical_wood_pulp
Dissolving_grades
Mech_chem_wood_pulp
TESAF
Dipartimento Territorio e Sistemi Agro-Forestali
Università degli Studi di Padova

16


Proportion of Raw Materials Used by Different Industries in 2018
Sawn_Wood
Veneer
Plywood
Particle_board
MDF_HDF
OSB
Hardboard
Other_fiberboard
Wood_residues
Other_agglomerates
Recycled_paper
Recycled_pulp
Graphic_paper
Other_paper_and_paperboard
Pulp_from_fibre
Chemical_wood_pulp
Dissolving_grades
Mech_chem_wood_pulp
Proportion of Total Wood Used
Industry
Building
Furniture
Green Chemistry
Others
Paper and cardboard
Wood packaging
Raw_Material
TESAF
Dipartimento Territorio e Sistemi Agro-Forestali
Università degli Studi di Padova

17

One final consideration

The importance of synergies

Istat → Sinfor ← INFC

Sinfor ↓

GRINS FOUNDATION → Modello FiLI (Filiere Legno Italia???) → ItaliaForestaLegno cluster nazionale

TESAF Dipartimento Territorio e Sistemi Agro-Forestali — Università degli Studi di Padova

20