Global Research Alliance Modelling Platform (GRAMP): An open web platform for modelling greenhouse gas emissions from terrestrial ecosystems

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GRAMP
Global Research Alliance Modeling Platform

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Outline

1. What is GRA?
2. Motivation for GRAMP
3. Aim and scope of GRAMP
4. GRAMP platform
5. A pilot study with DNDC
6. Conclusion

1. Global Research Alliance on Agriculture Greenhouse Gas Emissions

Launched December 2009 in the margins of the United Nations Climate Change Conference in Copenhagen, Denmark.

Aim: Find ways to grow more food without growing greenhouse gas emissions

- Improve understanding, measurement & estimation of agricultural emissions.
- Find ways to reduce emissions intensity of agricultural production systems and increase potential for soil carbon sequestration, while enhancing food security.
- Improve farmer access to agricultural mitigation technologies & best practices.
- Membership is voluntary with no funding obligations.

www.globalresearchalliance.org

Cross-cutting Groups

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Concert io

Livesto ea oup

Croplar e roup

Paddy F s Group

Inventory and Measurement

Soil Carbon and Nitrogen Cycling

Harry Clark, GGAA2013

- C & N process-based models are important tools in prediction and reporting of GHG emissions and soil C stocks.

- There are already several models that can address the questions related to C & N cycling and GHG emissions from soils Ex : DNDC, DAYCENT, COUP, ECOSSE. Roth C etc.,

- There are about 4000 mathematical models in the field of ecology and environmental sciences (Jøergensen et al.,1996). All of these models represent a large collection of scientific knowledge and experience about structure, function and behaviour of ecosystems.

- The biggest challenge is to unify these models and use them at different spatial and temporal scales, rather than to develop new models (Rotmans, 2009).

3. Aim and scope of GRAMP

➢To create an open web-platform with existing data and prior knowledge, in consort with end-users, with every stage open to critical review and revision to improve the predictions of soil C & N cycling in agro-ecosystems in the context of climate change.

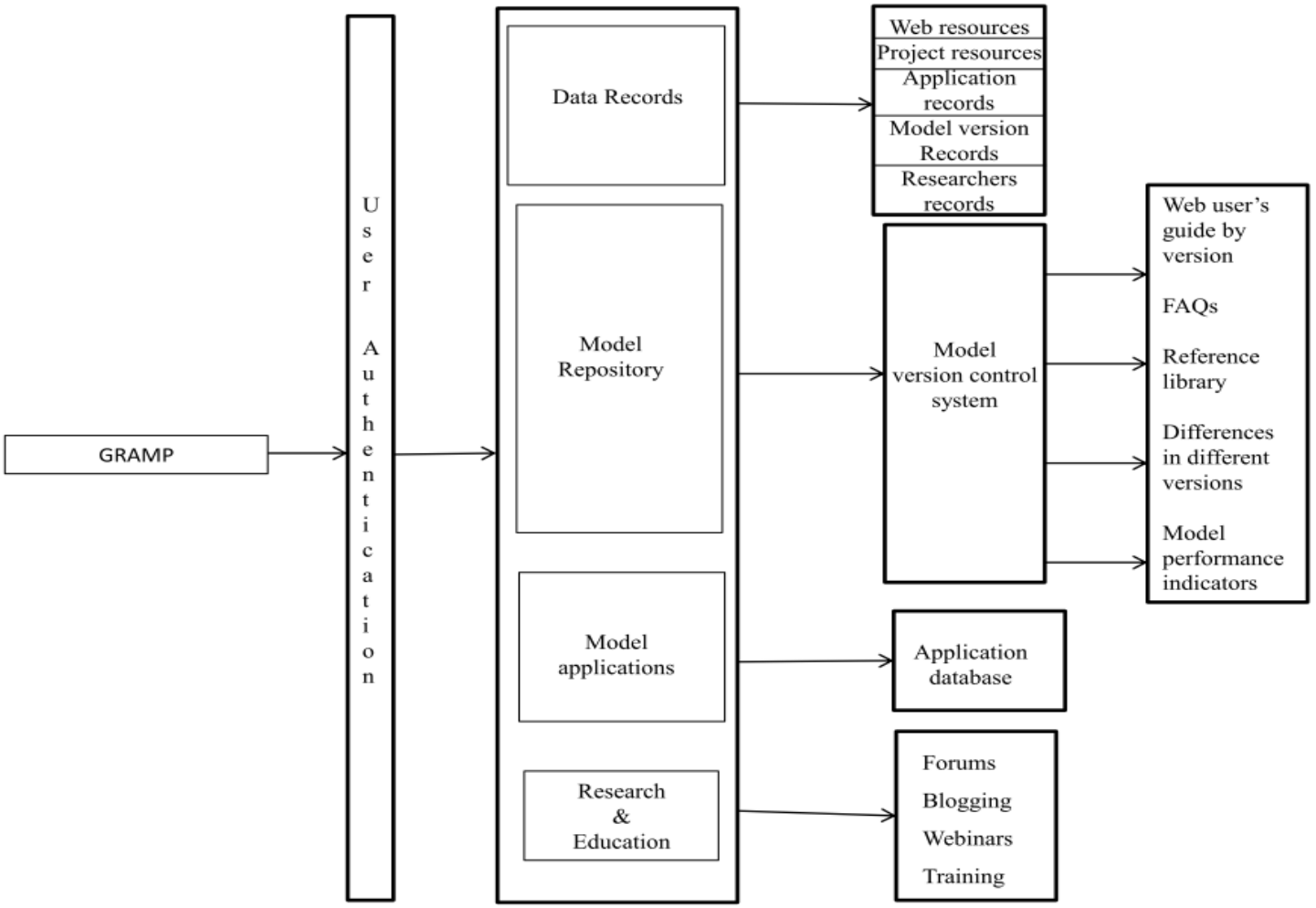
➢ Establish a vibrant network of specialist researchers, model developers and users who can work together, to examine strategically what the various models on the market can deliver in accounting for the effect of ecosystem management on GHG emissions.

➢ Allow network members to exchange information, experience and data and provide a forum for model development for future needs.

➢ Creating a virtual labs with version control systems, blogging, Webinars, forums with more interactive tools for easy exchange of ideas and expertise across the world.

➢Linking up a network of experimental sites across the world.

4. GRAMP platform



A schematic representation of the GRAMP network

Uses:

1. Researchers working on model development

2. Researchers using models for various outputs

3. Students who want to be trained in ecosystem modelling

4. Researchers interested in policy making, based on modelling outcomes.

Content and database management system:

- *GRAMP will allow users to link databases for use by the GRAMP community.*

- *The GRAMP platform contains a content management system and a database system which are searchable by region, crop etc.*

- *It also contains a web-GIS linked mapping system with a reference library, a database system and training materials (case studies, demos, videos).*

Model repository :

- *The repository uses version-control tools. This will also provide version-specific documentation, which is easily accessible, complete, standardized, mutually comparable and transferable to different applications.*

Model application:

- *Model performance with different model versions is documented in this category. Different statistical performance indicators are used to compare the performance of different versions of model.*

***Research & education*:**

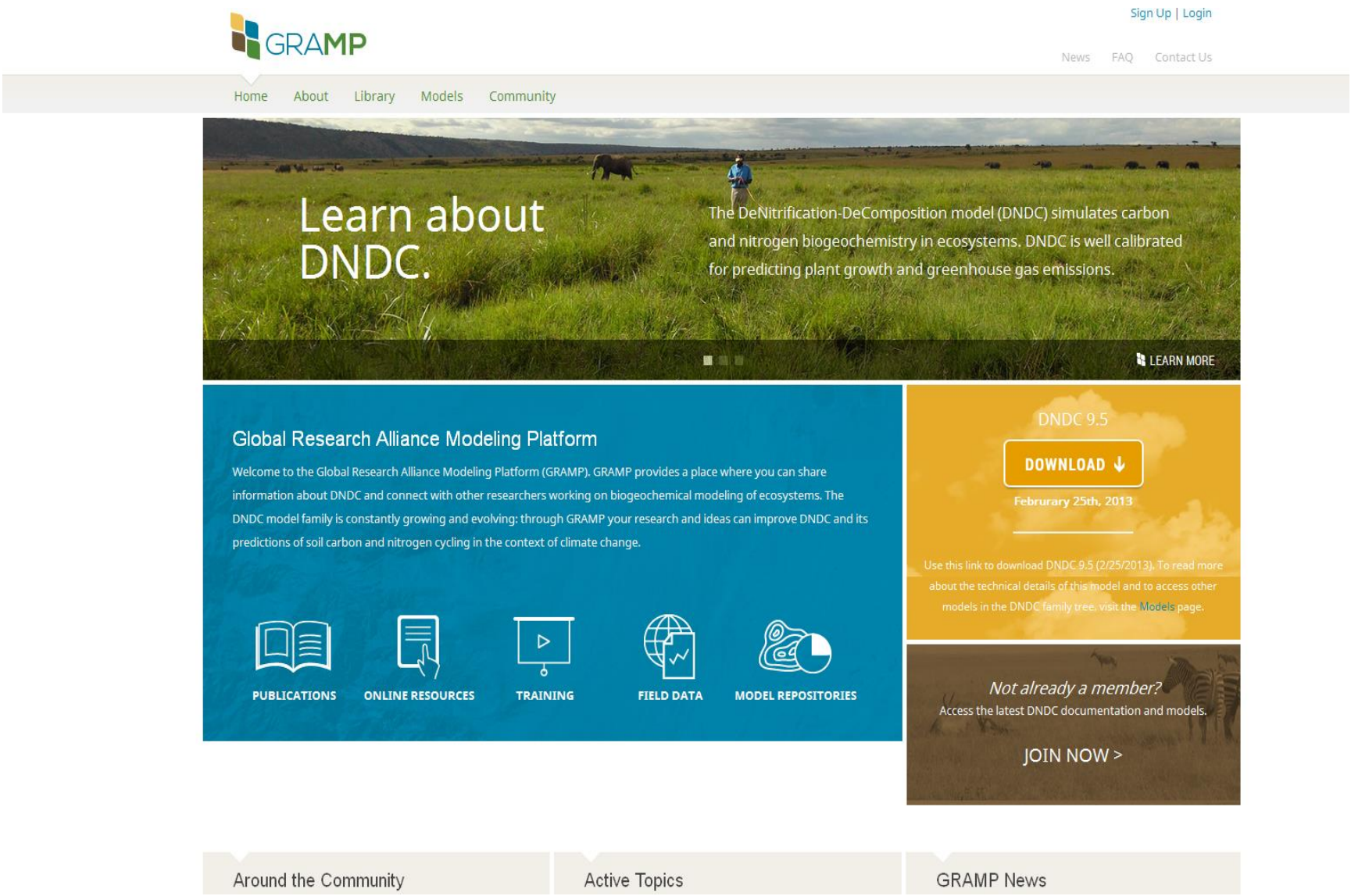
- *Provides the training manuals, videos, tutorials for new users and provides FAQs.*

- *Users are allowed to interact in the forums and raise questions and get help from worldwide colleagues to solve questions*

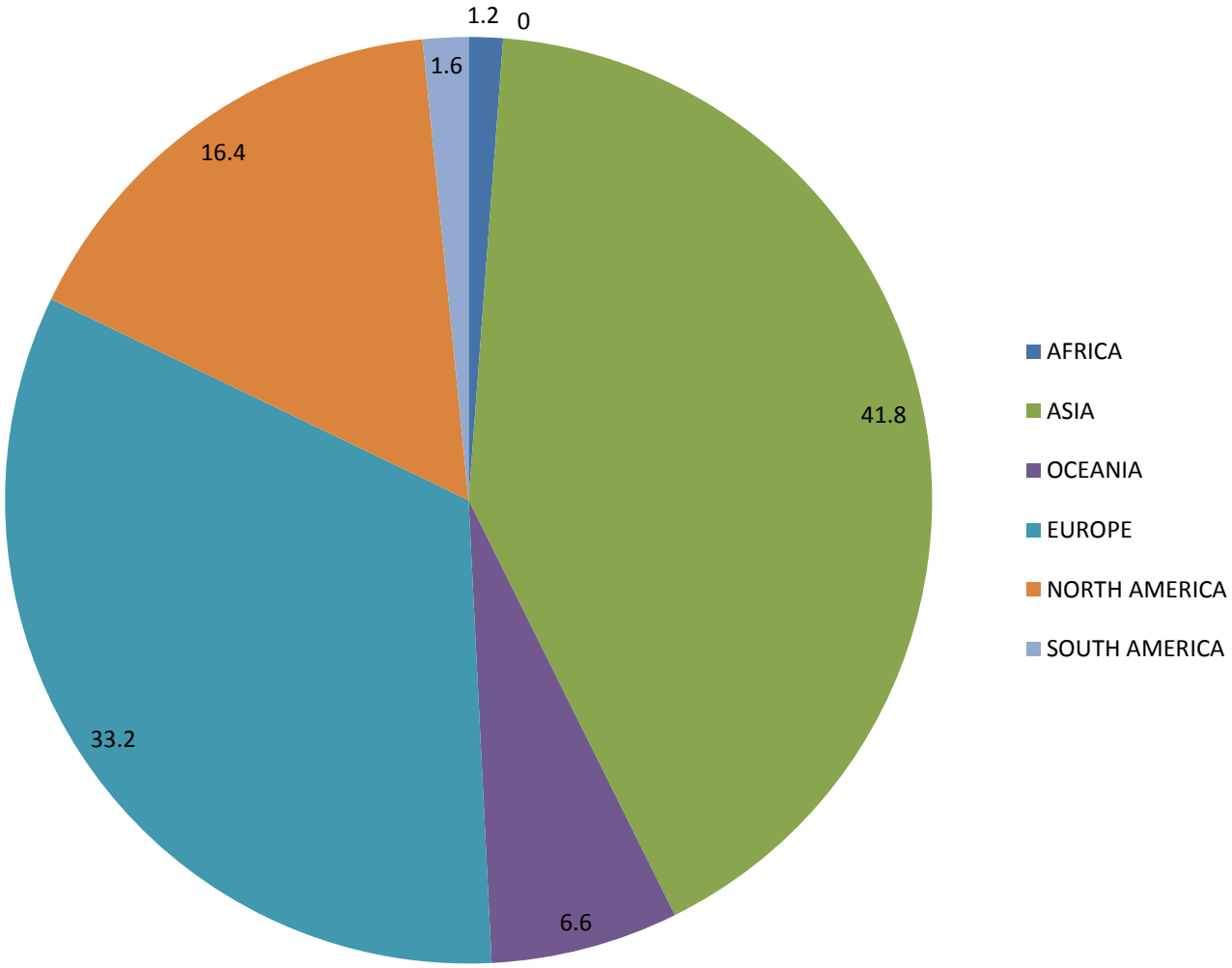
- *Tools are provided for blogging, which allow experienced users, developers and eminent scientists in this field to communicate with the audience.*

- *GRAMP also has the capabilities to organize Webinars, which allow scientists across the world to attend web-based seminars.*

3. GRAMP platform



5. Pilot study - DNDC



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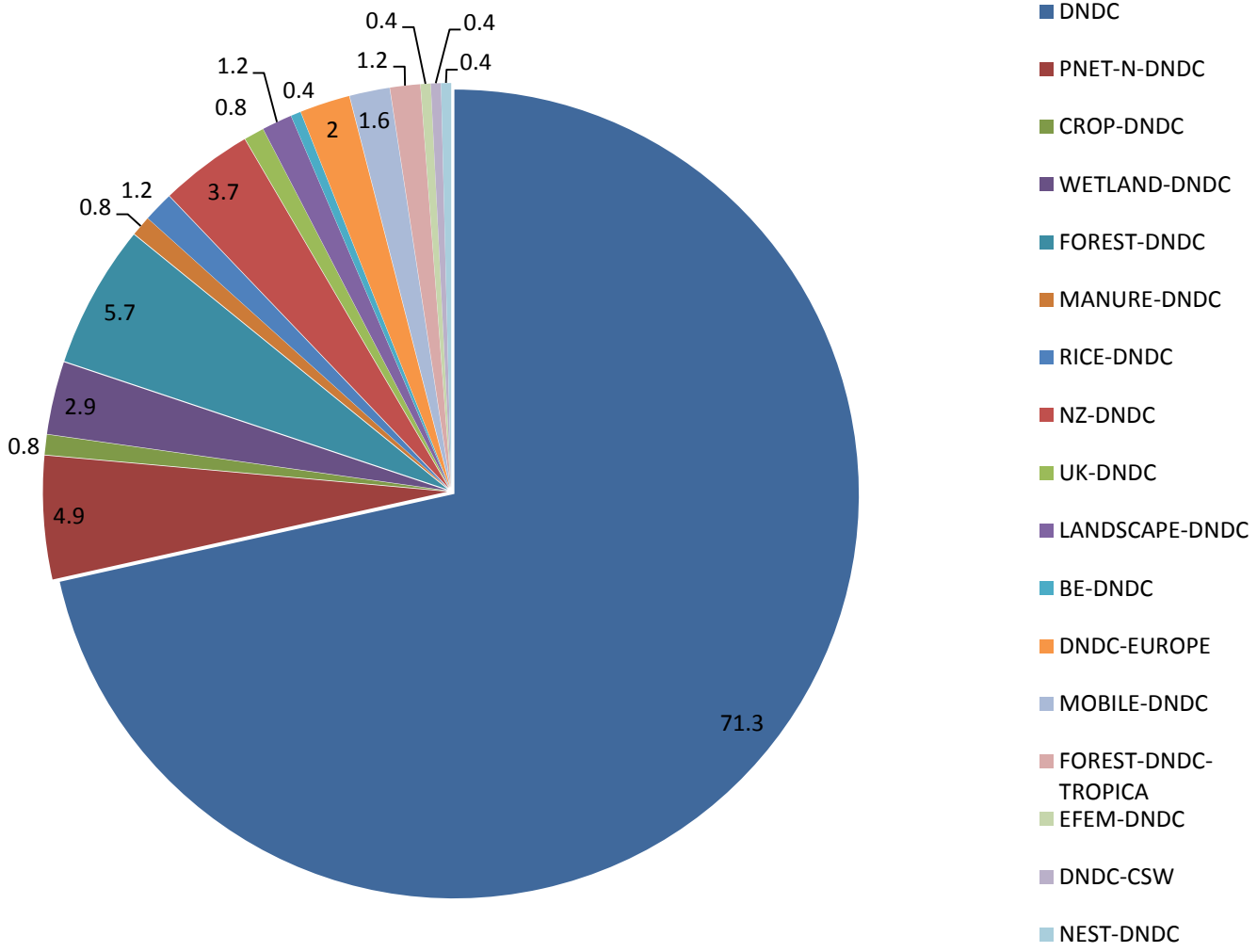

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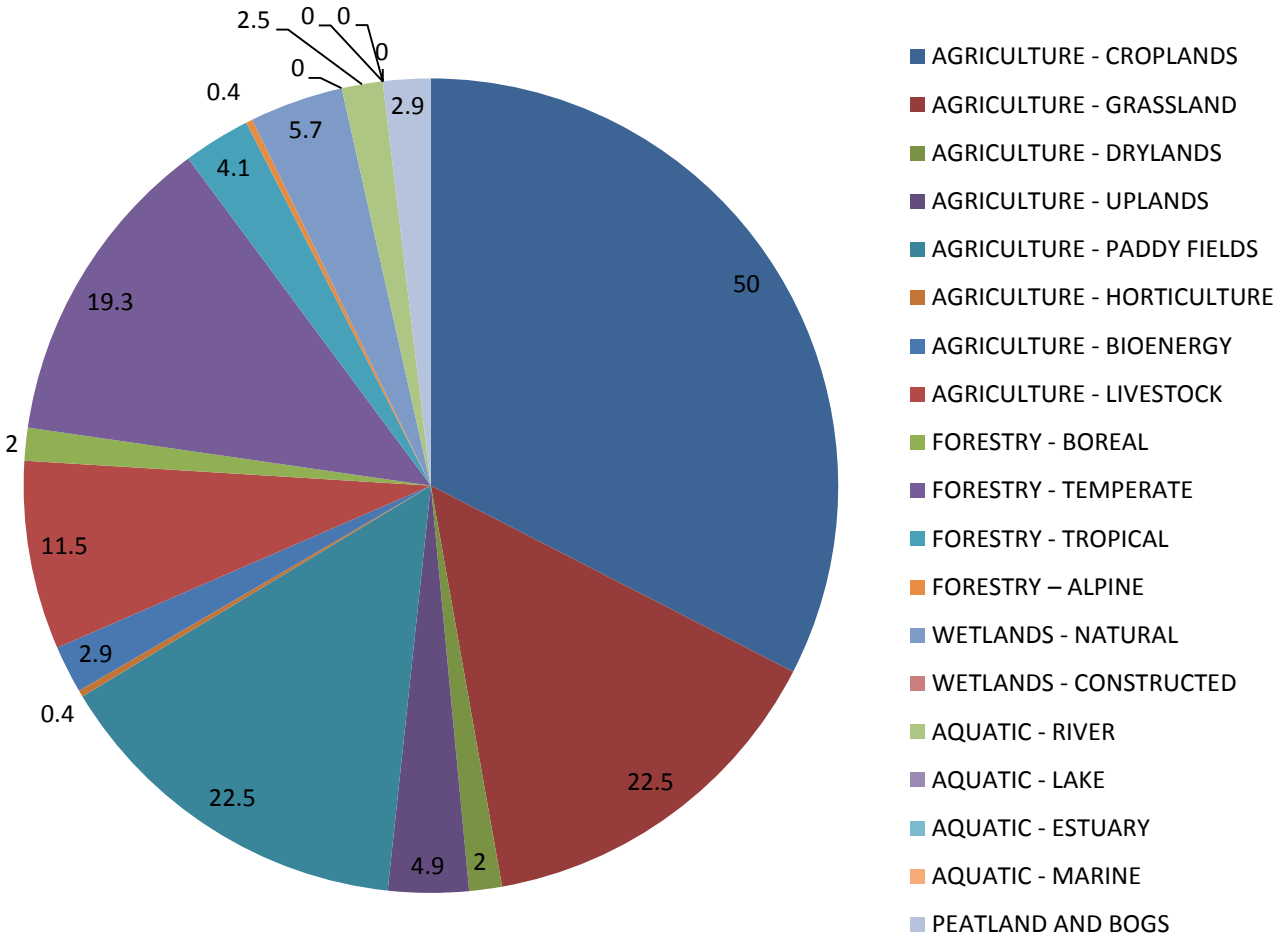

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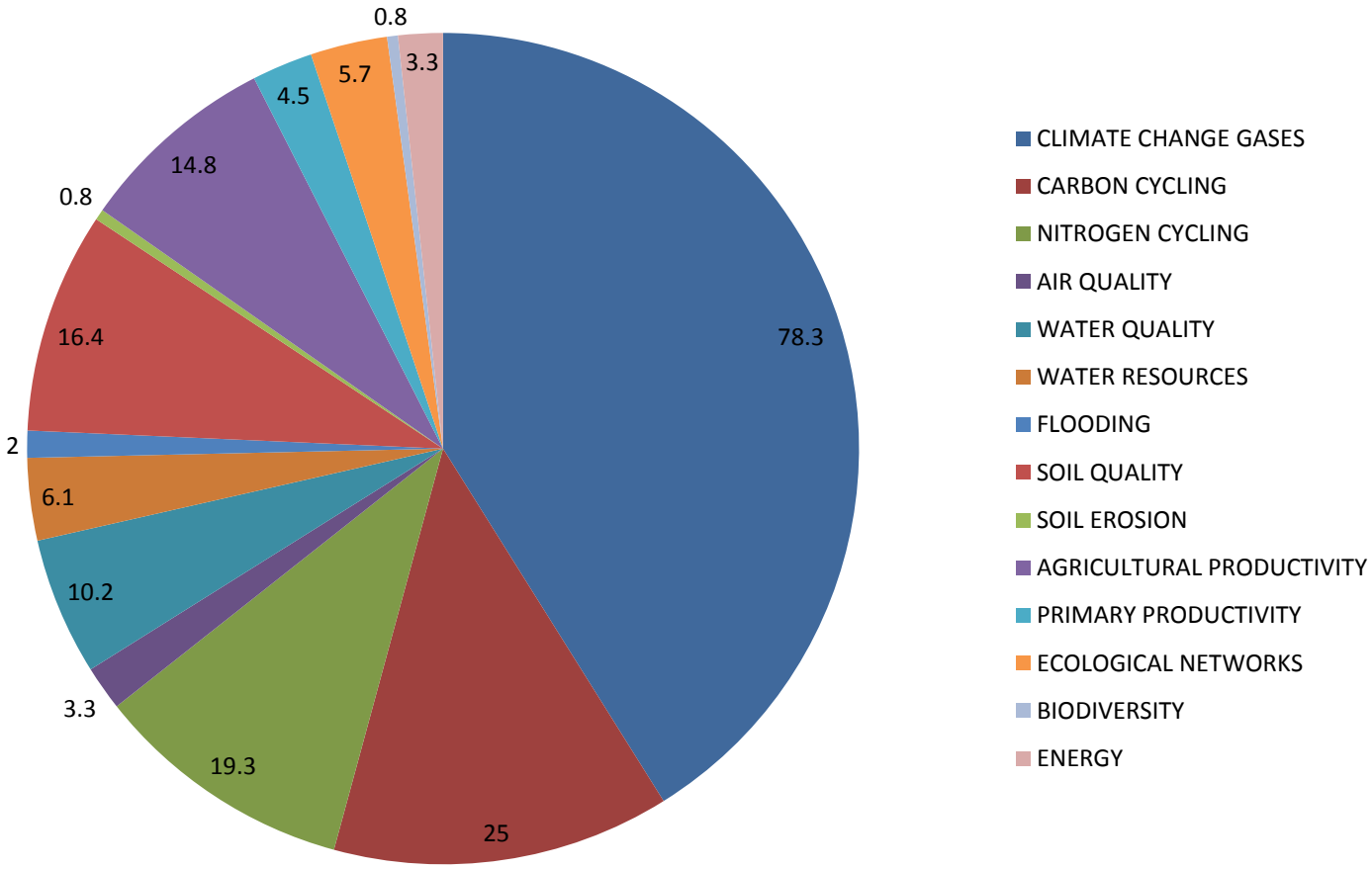


5. Pilot study - DNDC

No.	Name	Description	Percent of Papers
1	Development, integration and testing	Detailed description and testing of new algorithms for improved process representation.	24.6
2	Measurement and verification	Comparison of model outputs with measured fluxes at plot and field scale for verification and calibration of the model parameters.	57.0
3	Inter comparison	Comparison of the abilities of different models or model versions to reproduce measured fluxes	15.6
4	Sensitivity and uncertainty	Analysis of the sensitivity of model outputs to varying the scale and range of input data and internal model parameters.	26.6
5	Scenario evaluation	Application of the model to calculate the impact of, for example, a change in land management or climate change on simulated fluxes.	33.6

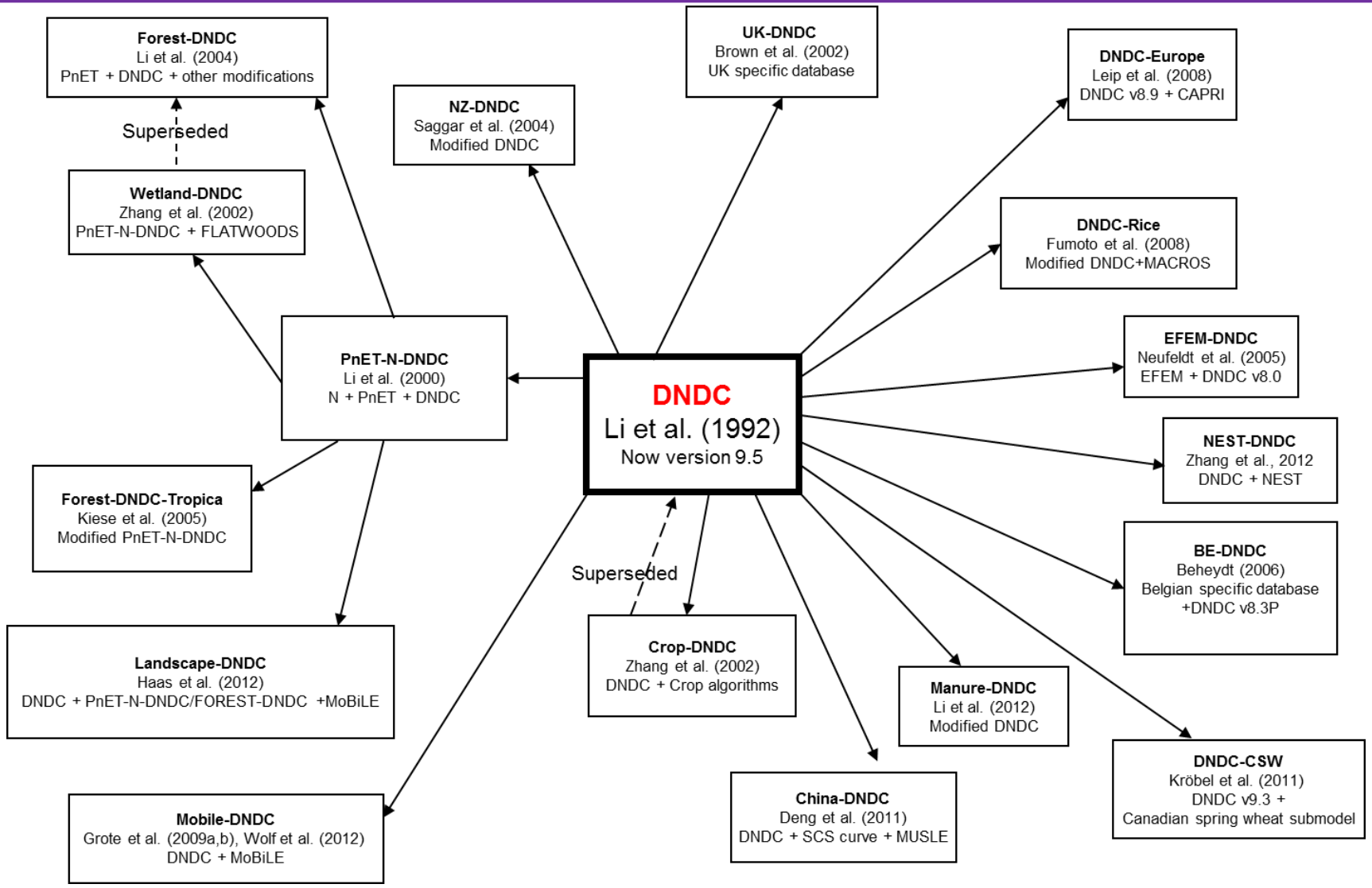
5. Pilot study - DNDC

No.	Name	Description	Percent of Papers
1	BASELINE CHARACTERISATION	Quantification of trace gas fluxes.	68.0
2	CLIMATE CHANGE IMPACT	Quantification of the impact of changing climatic rainfall and temperatures on environment fluxes.	14.3
3	LAND MANAGEMENT CHANGE IMPACT	Quantification of the impact of land management change on modelled fluxes, such as the adoption of minimum tillage.	35.7
4	FLOOD MANAGEMENT CHANGE IMPACT	Quantification of the impact of options for land drainage and flood management on modelled fluxes.	0.0
5	LIFE CYCLE ASSESSMENT	Integrated quantification of modelled fluxes, including those associated with upstream agricultural inputs.	1.6
6	ECONOMIC ASSESSMENT	Analysis of the cost effectiveness of land management options to reduce environmental pressures, and the economic optimisation of agricultural production	5.7
7	MODEL, METHOD OR GUIDANCE	A new or improved version of a model, a methodology, or guidance for the application of a model.	25.0
8	LAND USE CHANGE IMPACT	Quantification of the impact of land use change on modelled fluxes, such as the conversion of grassland to cropland.	2.9
9	DATASET	A dataset of model based outputs or improved input data, such as an archive of model simulations for present and future climate, or a new soils dataset for a region.	2.0

5. Pilot study - DNDC

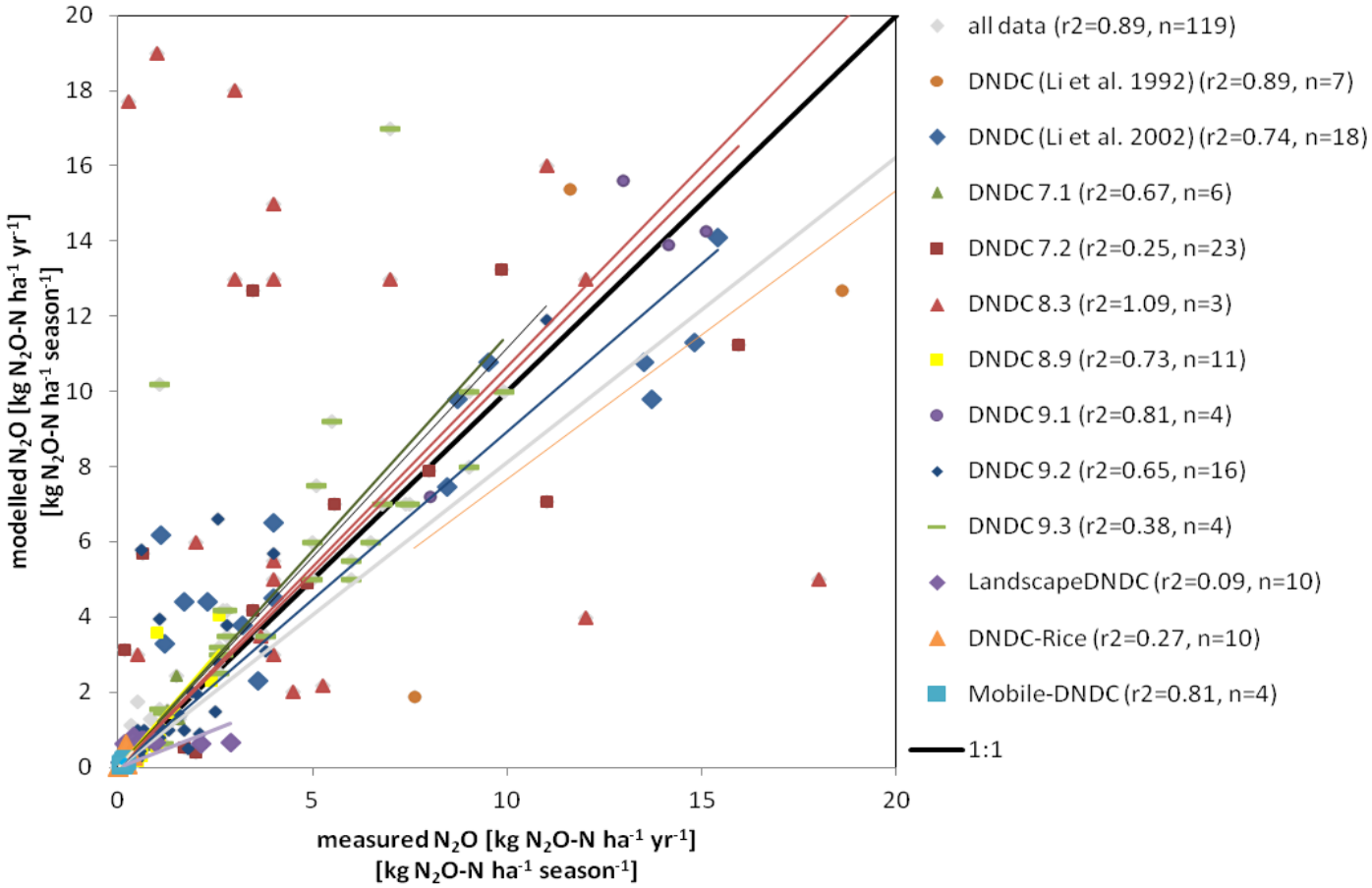
YEAR	Model versions		
1992	DNDC		
……..			
2000	PnET-N-DNDC		
2002	Wetland DNDC	UK-DNDC	Crop-DNDC
2004	Forest DNDC	NZ-DNDC	
2005	Forest DNDC Tropica	EFEM-DNDC	
2006	BE-DNDC		
2008	DNDC-Europe	DNDC-Rice	
2009	Mobile-DNDC		
2010			
2011		DNDC-CSW	
2012	Landscape-DNDC	Manure DNDC	NEST-DNDC

5. DNDC – Model tree



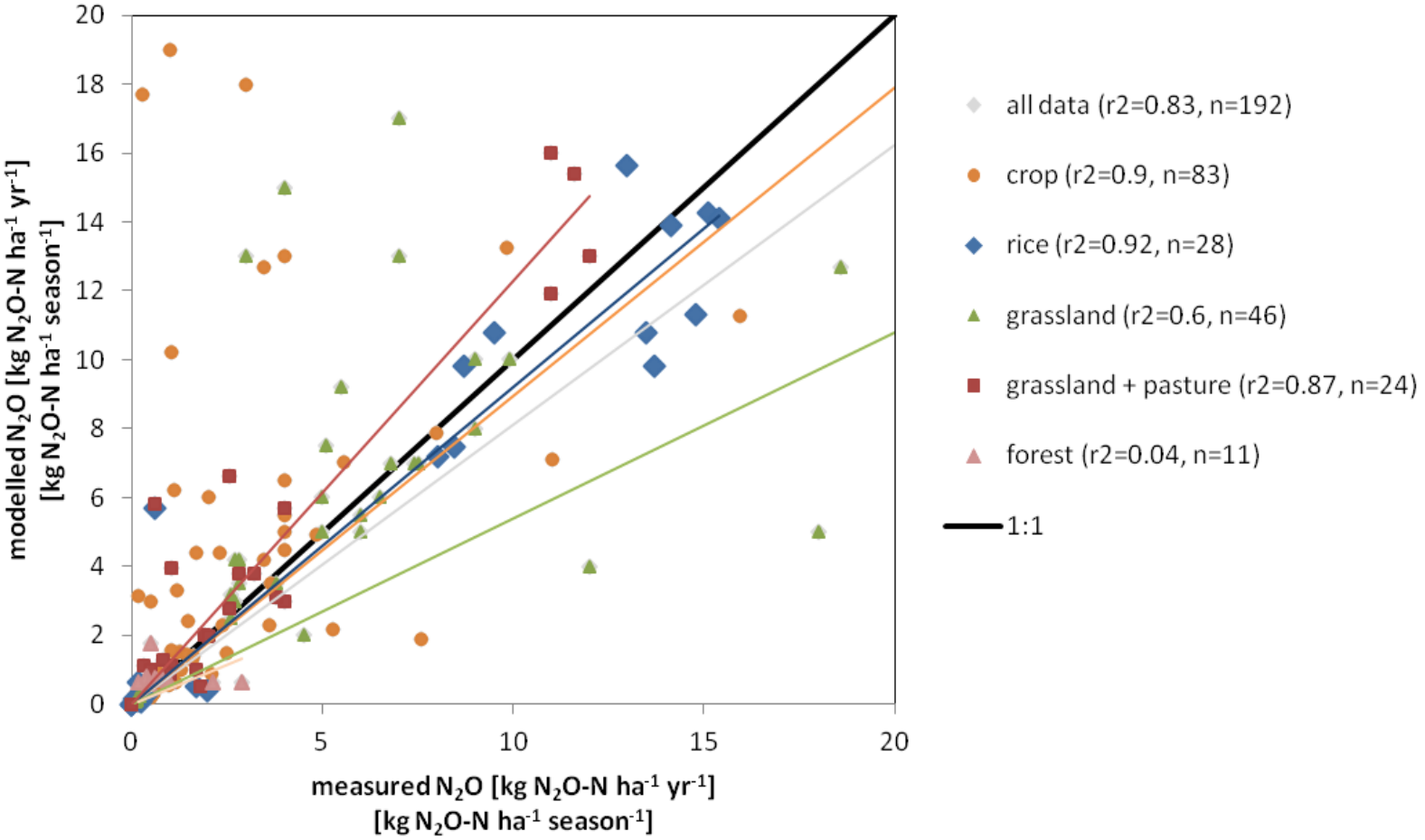
Schematic diagram of the DNDC extended family

5. Pilot study – DNDC model performance

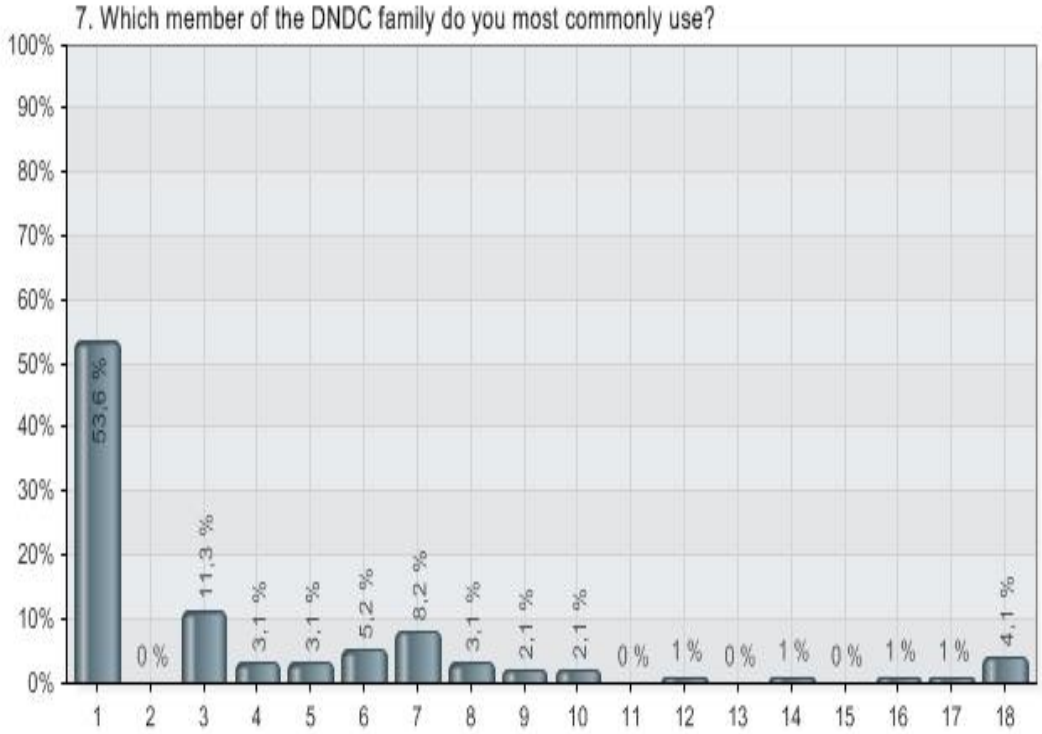


Measured and modelled total or annual N_2O sorted by model version, extracted data from publications

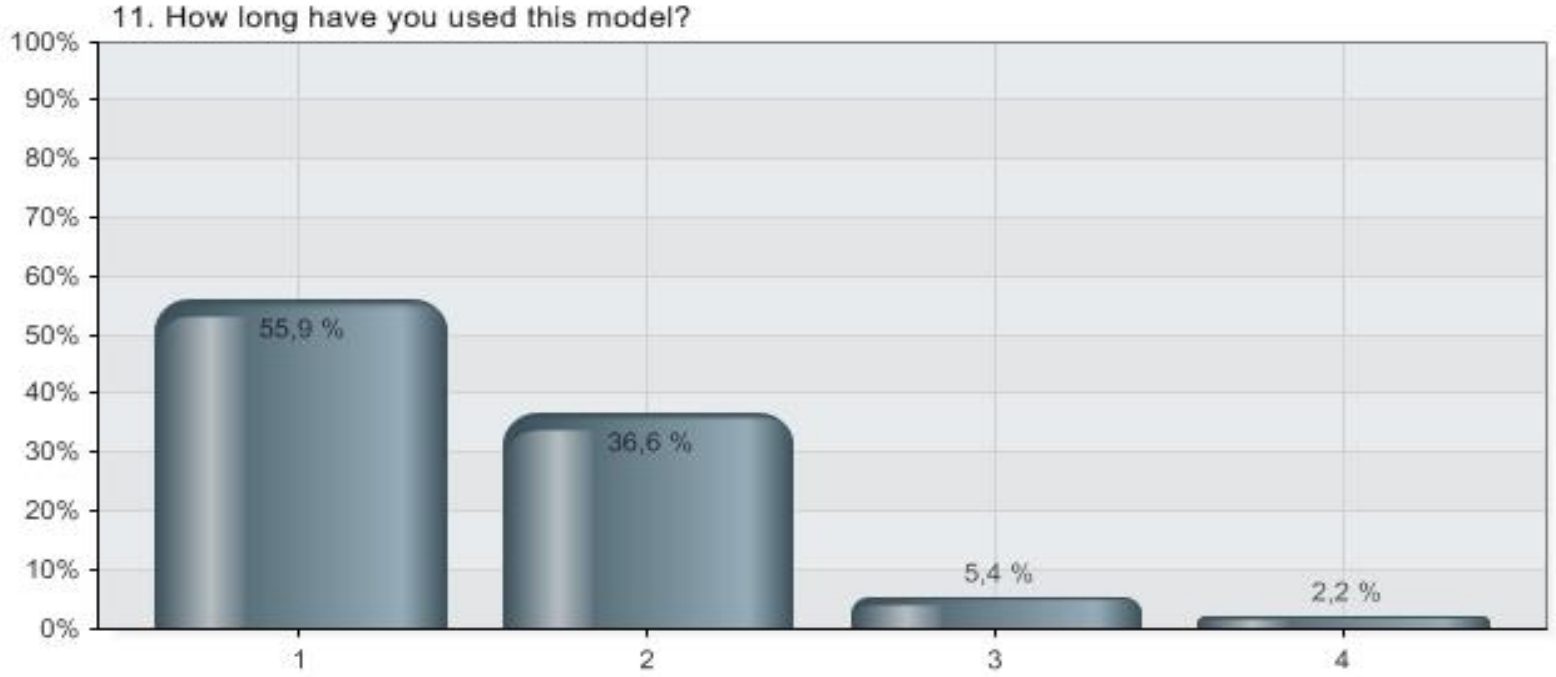
5. Pilot study – DNDC model performance



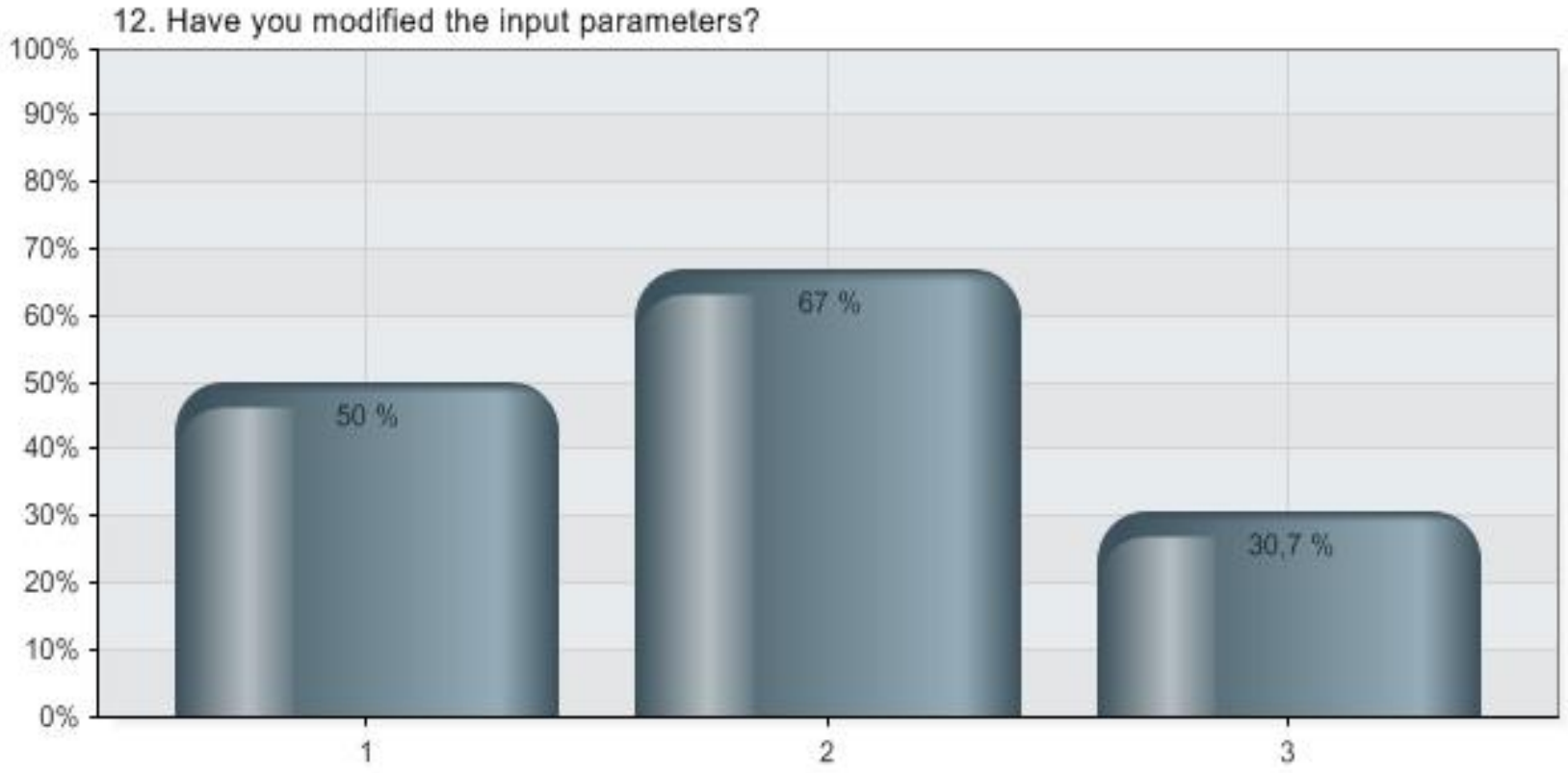
Measured and modelled total or annual N_2O sorted by model land use, extracted data from publications



Alternatives		Percent
1	DNDC	53,6 %
2	PNET-N-DNDC	0,0 %
3	CROP-DNDC	11,3 %
4	WETLAND-DNDC	3,1 %
5	FOREST-DNDC	3,1 %
6	MANURE-DNDC	5,2 %
7	RICE-DNDC	8,2 %
8	NZ-DNDC	3,1 %
9	UK-DNDC	2,1 %
10	LANDSCAPE-DNDC	2,1 %
11	BE-DNDC	0,0 %
12	DNDC-EUROPE	1,0 %
13	MOBILE-DNDC	0,0 %
14	FOREST-DNDC-TROPICA	1,0 %
15	EFEM-DNDC	0,0 %
16	DNDC-CSW	1,0 %
17	NEST-DNDC	1,0 %
18	Other - please specify	4,1 %



Alternatives		Percent
1	< 1 year	55,9 %
2	1-5 years	36,6 %
3	5-10 years	5,4 %
4	10+ years	2,2 %



Alternatives		Percent
1	Default crop growth	50,0 %
2	Soil parameters for which there are default values	67,0 %
3	Other? Please specify	30,7 %
Total		

6. Conclusion

- GRAMP anticipated to bring more fundamental understanding of C-N interactions at different scales and improve the interaction between modellers, experimentalists and users, to synthesize solutions in the problem areas of model application and validation.

- GRAMP will act as a global communication tool between research teams and model users, specifically interested in the measurement and modelling of GHG mitigation.

- GRAMP will bring greater transparency in model development and application.

- Using this web-platform, the modelling community along with end users can build well documented models and harmonise existing methodologies.

www.gramp.org.uk

On 7th November

2013