ADAPTIVE MANAGEMENT OF PINK-FOOTED GOOSE IN DENMARK USING AGENT-BASED SIMULATION: SYSTEM AND APPROACH

Part of the ”Forbedret Gåsejagt” Project

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OVERALL PROJECT OVERVIEW


Foto: Magnus Elander

Aim is to study how voluntary agreements can be used as a tool to regulate hunting organization

Series of hunting organisation experiments (voluntary agreements between landowners, hunters and AU)

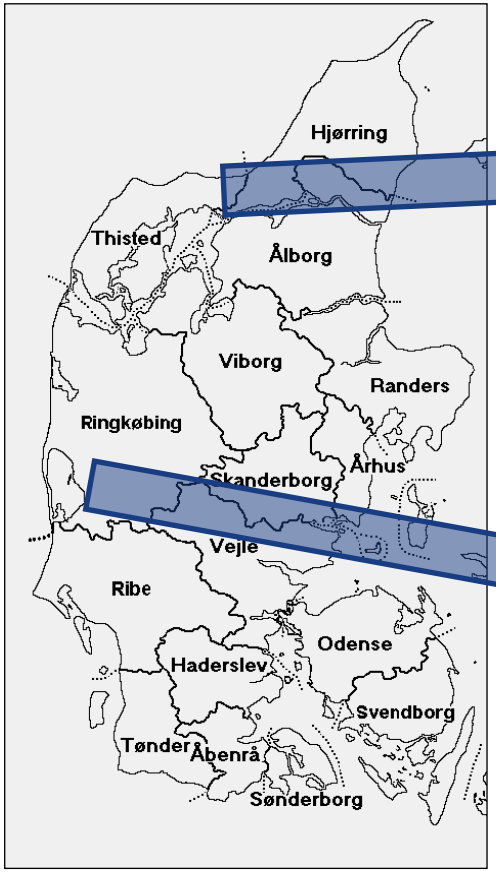
3 iterative cycles, learning from the experiences from previous seasons by adjusting hunting behaviour

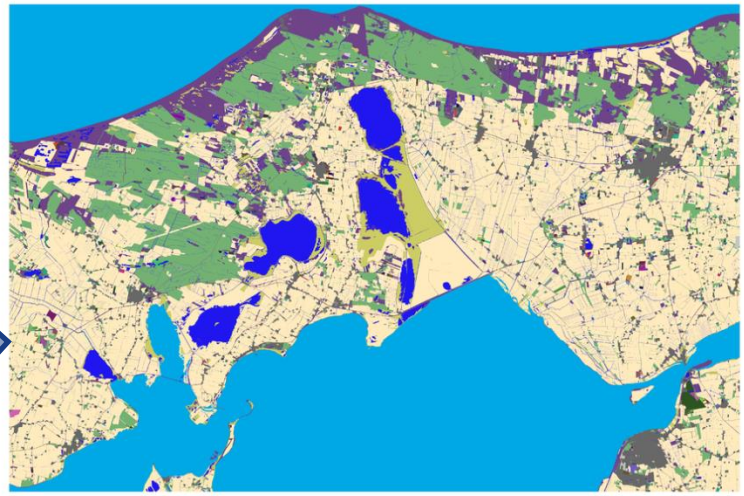
Develop models to produce various scenarios to:

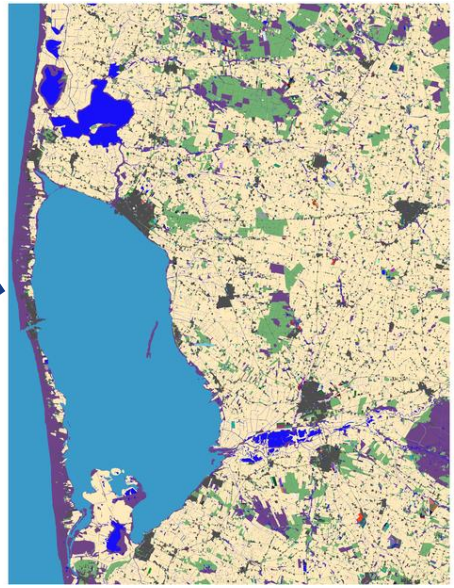
Predict the outcome of the upcoming season of hunting experiments,

Advise on how to organize goose hunting over a wider area

STUDY AREAS



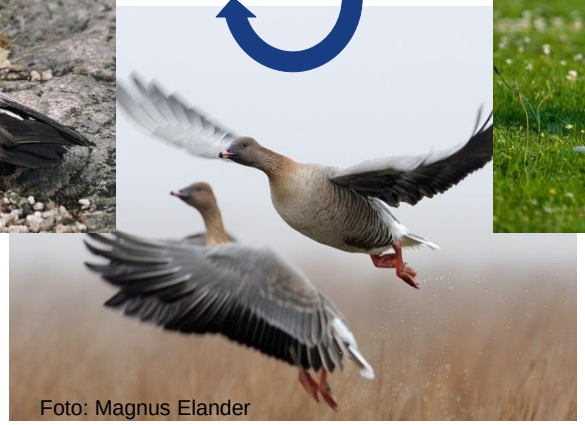




The two study areas for modelling from N. Jutland and W. Jutland

LOCAL SYSTEM OVERVIEW

Barnacle Goose



Pink-footed Geese

Greylag Goose

Farmers

Hunters

GEESE MAKE DECISIONS

- Where are these geese going?
- Why are they flying in a mixed flock?
- What caused them to leave the last field?
- Do they have a long-term goal?

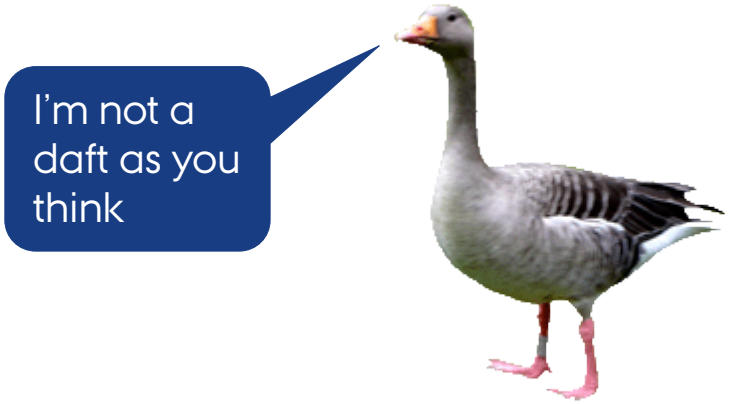



Foto: Jørgen Peter Kjeldsen

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WHAT DO GEESE DO AT A FEEDING SITE?

They eat grains, spilled maize or graze

Different species have different feeding preferences and abilities

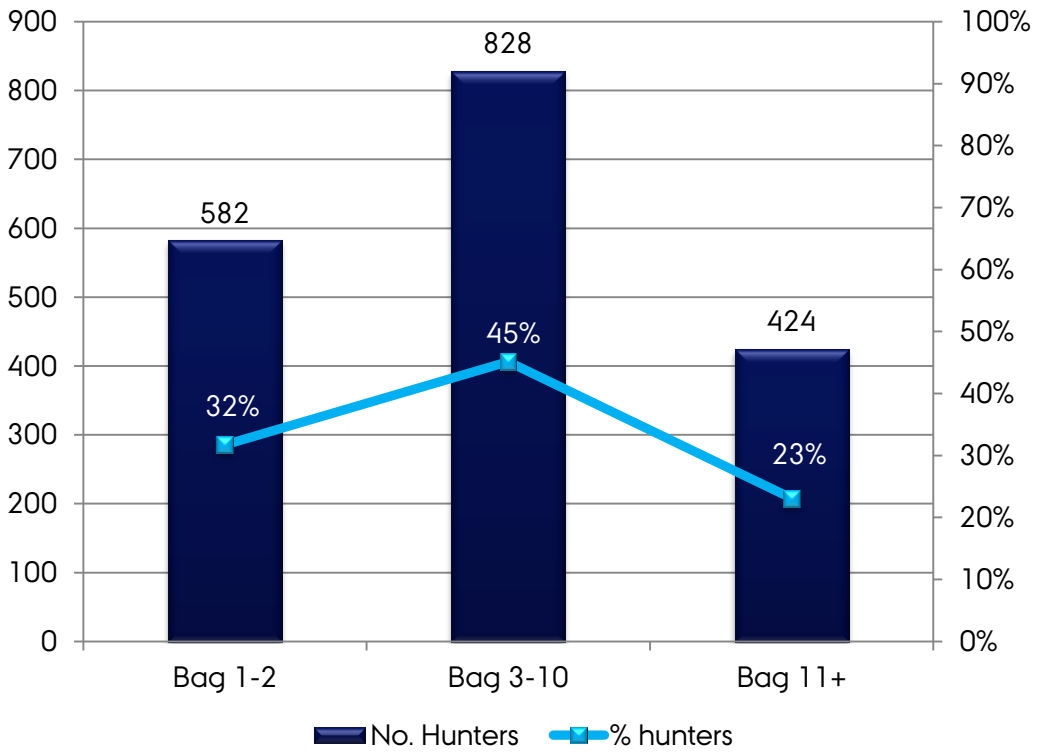
Family groups are less tolerant of competition than non-breeders

Geese react to threats by flying away (predators or guns)

They remember things, both good and bad, and use this information to make decisions about where and how to forage.

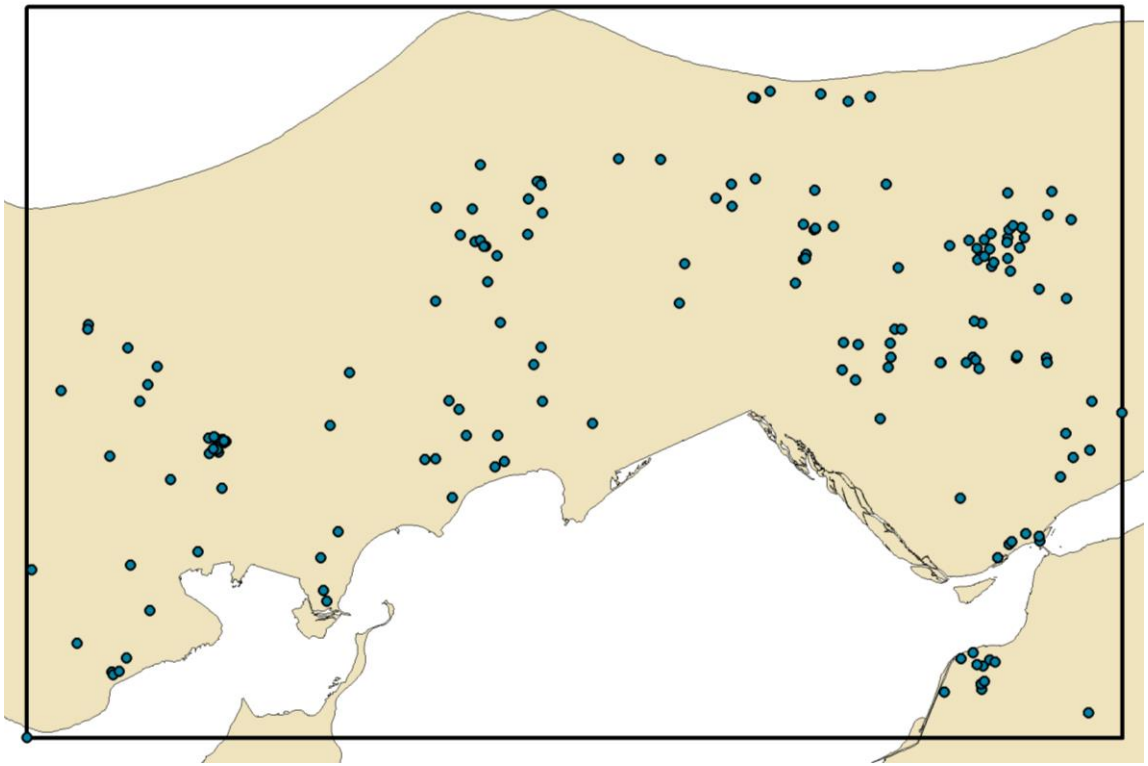
HUNTERS ARE A DIVERSE GROUP

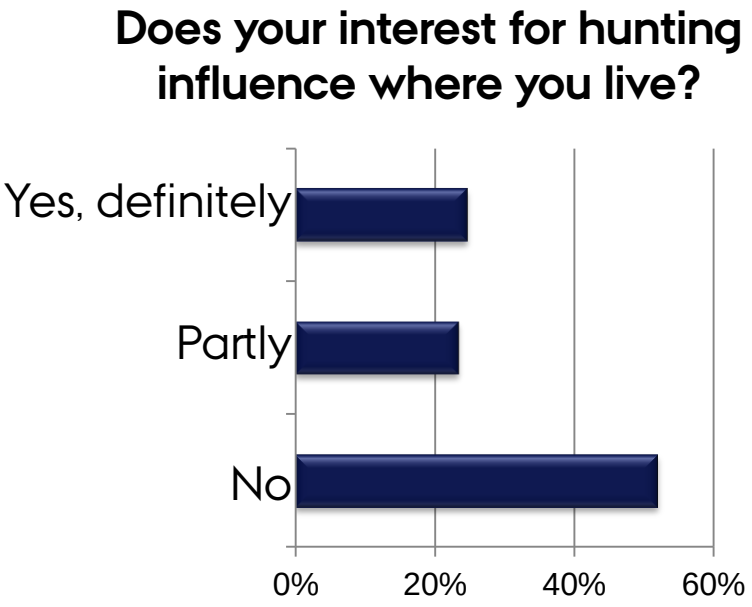
Pink-feet hunting bag size 2013-2014



- A small section of "active hunters" have a big impact on the goose hunting bag
- 23% had shot> 10 geese in the 2013-14 season
- These "active hunters" shot 69% of all geese & 56% of pink-feet

HUNTERS ARE A DIVERSE GROUP





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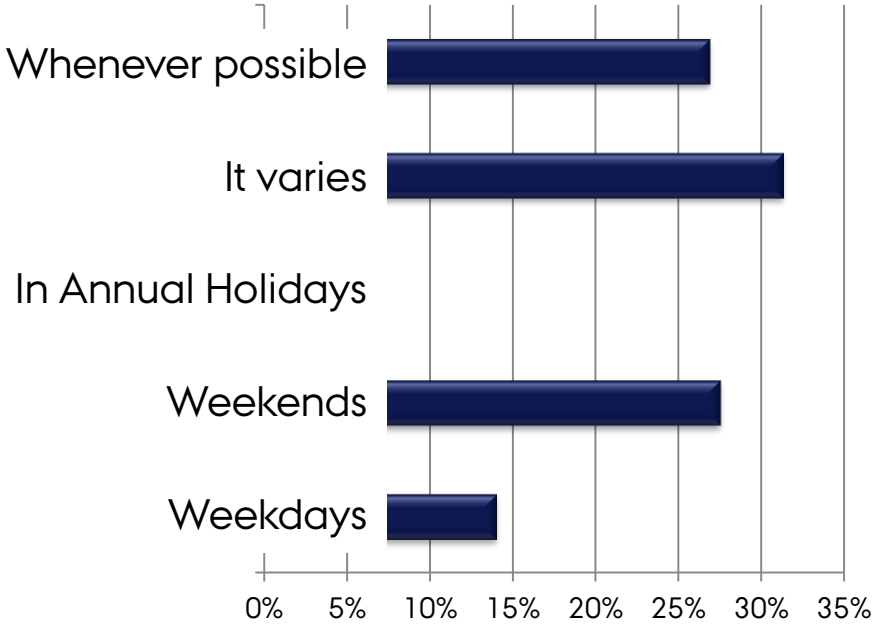
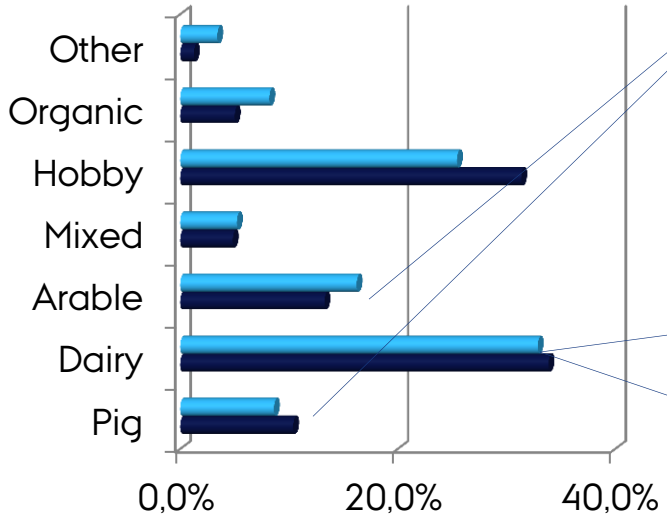
HUNTERS ARE A DIVERSE GROUP

Which of the following best describes when you went hunting in 2014?



FARMING CREATES DIVERSE CONDITIONS FOR GEESE

Farm types: % by number



Different farms have different crops resulting in different types of forage for geese

HOW DO WE INTEGRATE ALL THIS?

AGENT-BASED SIMULATION & AGENTS

Software agents (geese, farmers, hunters) are individuals and obtain their information in the same way as they would in the real world, then act on it to make decisions to further their own agenda.

ABS produces emergent and dynamic behaviour and have considerable predictive power.

HOW DO WE INTEGRATE ALL THIS?

ALMaSS – a model system, C++, creates a virtual world into which we can put the hunters, geese and farmers. Can handle millions of concurrent agents

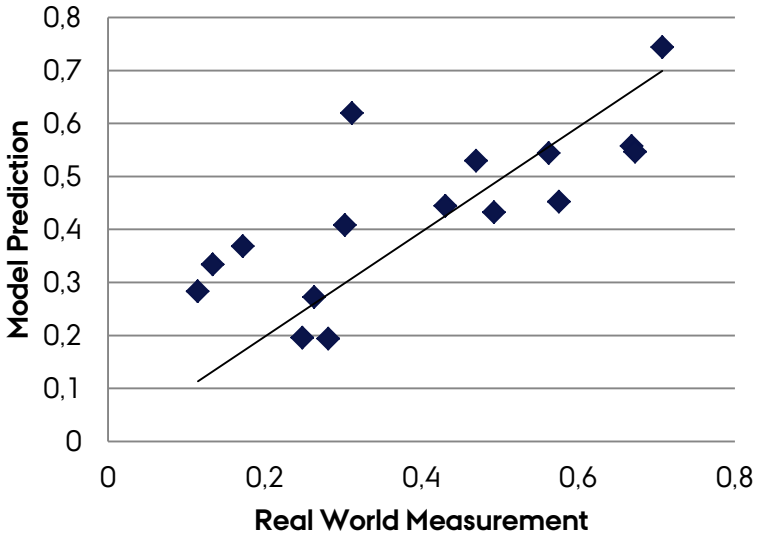
AGENT EXAMPLE: GEESE PROPERTIES

- Ability to constantly sense environment for food and hunting events, other geese and habitat structure
- Foraging memory
- Memory of hunting events
- Cognitive ability
- Social-learning
- Migratory decision making
- Physiological condition


Foto: Fred Cottaar

SO WE HAVE A MODEL – WHAT THEN?

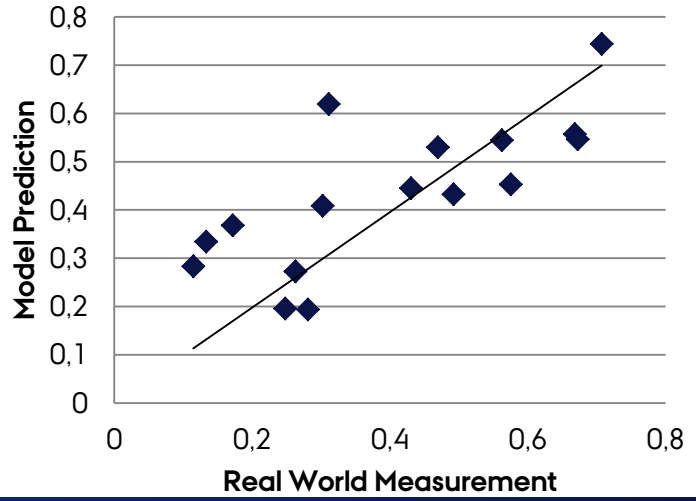
Model Testing



….but we normally look at many of these at once

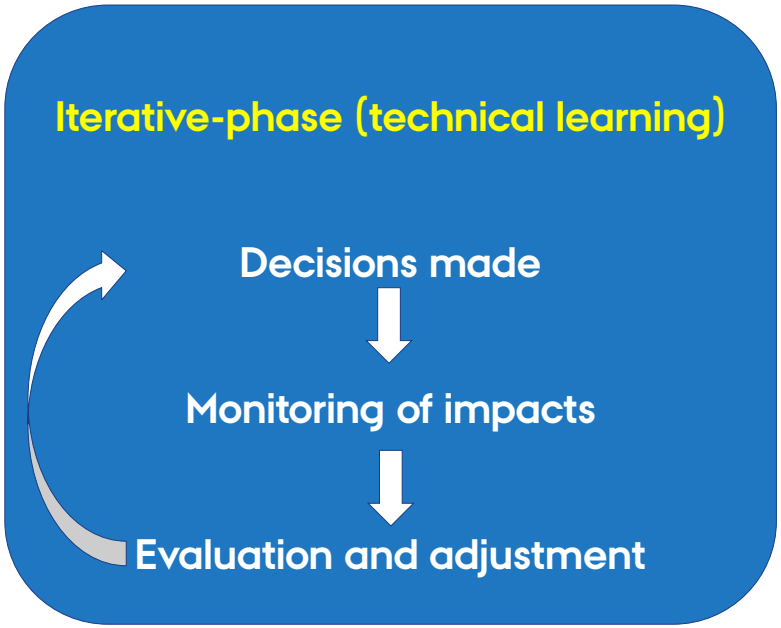
GOOSE MANAGEMENT MODEL PATTERNS

- Distance hunters travel to hunt
- Number of hunters and distribution of hunters in and between hunting locations
- Total goose bag for each species
- Distribution of goose bag sizes (e.g. between hunters)
- Location of feeding geese
- Weight gain of feeding geese
- Length of stay of geese in our study areas
- PLUS changes in the above with time

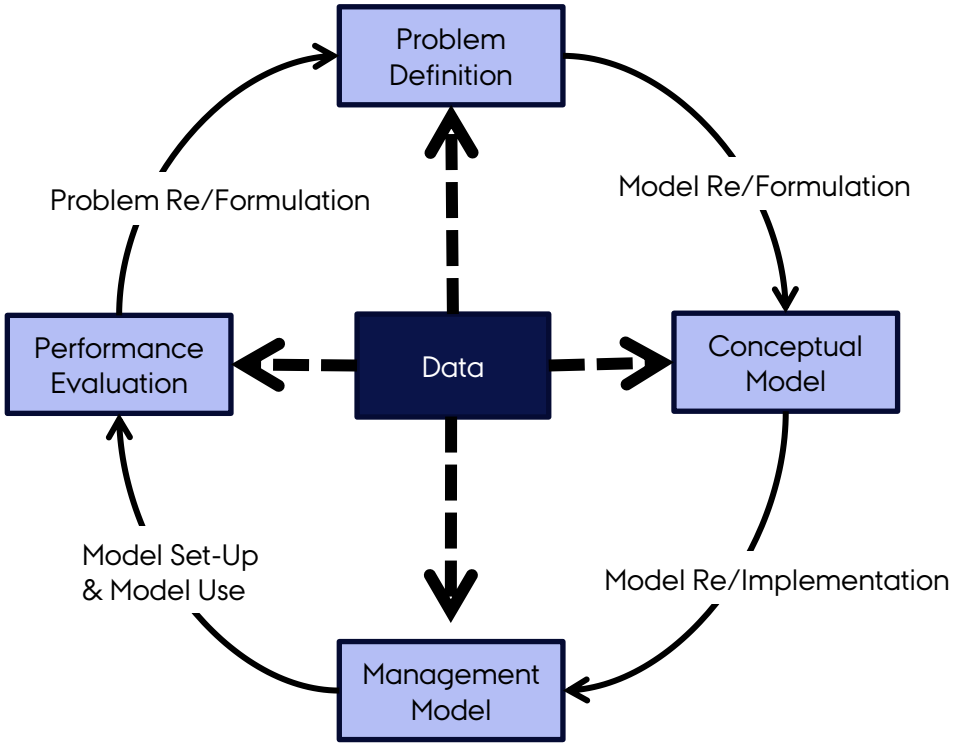


THE MODELLING CYCLE AND ADAPTIVE MANAGEMENT

Adaptive Management Process



Modelling Cycle



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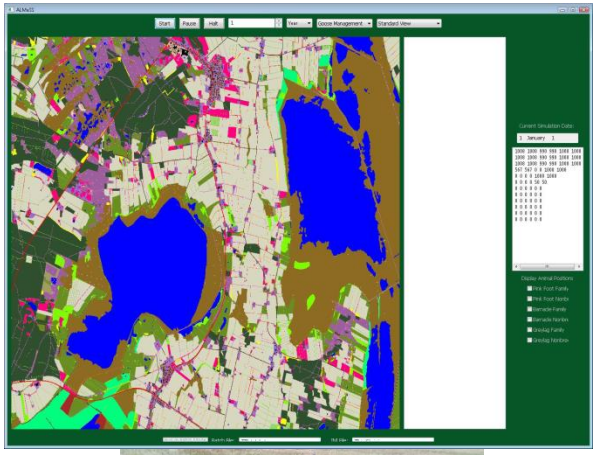
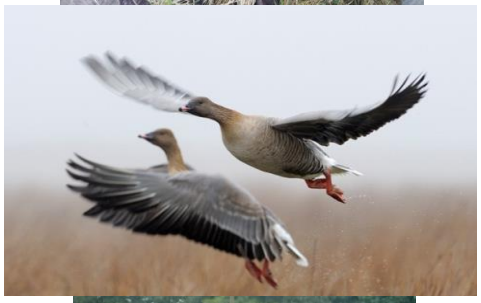
FINAL POINTS ABOUT ABS

- This model is an engineering approach to applied ecology
- Widely applicable to social-ecological systems
- The **drawbacks** are technical complexity and data requirements (therefore high costs and long development time)
- The **advantages** are:
  - **Testability/Validation**
    - linked to the iterative AM process
  - **Predictive power**
  - **Flexibility**
    - many questions can be answered





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