

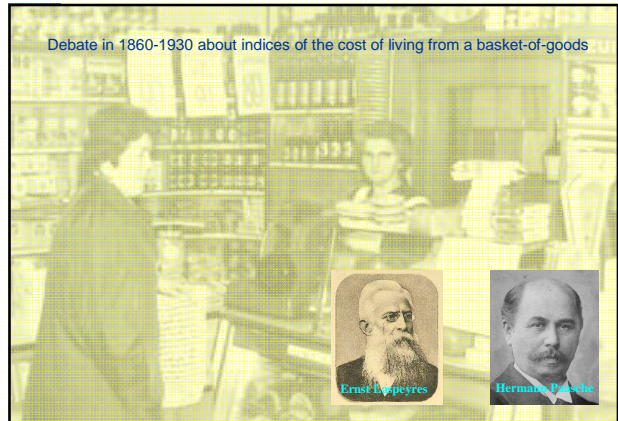
Wild bird indicators – methodological strengths, weaknesses and possible improvements

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with help of Lodewijk van Duuren, Petr Vofíšek, Jana Škorpilová, Leo Soldaat, Richard Gregory, Ruud Foppen & Tom van der Meij



Debate in 1860-1930 about indices of the cost of living from a basket-of-goods



Debate in 1860-1930 about indices of the cost of living from a basket-of-goods

Issues:

- How to aggregate prices of commodities? Arithmetic, geometric, harmonic mean?
- Many commodities or only a few important ones (bread, cotton and beer)?
- How to select commodities for a basket-of-goods?
- Weighting of commodities? by quantities used?
- Can it be computed in practice?
- (In later years) how to make sensible comparisons between countries?
- Has it a meaning all together?

Many procedures suggested

Big question: which is the best one?

Debate in 2002-2012 about a statistic to summarize changes in abundance across a set of common bird species (wild bird indicators)

Issues:

- How to aggregate species trends? Geometric mean, arithmetic mean, diversity indices, similarity indices?
- Many species or important ones only (e.g. skylark and)?
- How to select species for a species group?
- Weighting of species? by habitat specialisation?
- How to make sensible comparisons between countries?
- Has it a meaning all together?

Debate about wild bird indicators not unique.

Many parallels with price index debate

What can we learn from the historical debate on price indices?

Debate in 1860-1930 about indices of the cost of living

To find the best way of assessing indices >> test approach adopted

Price index passing most logical/mathematical tests >> best index

Price index passing all logical/mathematical tests >> "king of indices"

Tests are among others:

- Monotonicity test: all prices go up >> index of cost-of-living should go up
- Proportionality test: all prices double >> index of cost-of-living should double
- Identity test: all prices in year X equal prices year 1 >> index should be equal

Price index theory rules are mathematical and logical tests >> also apply to other fields

Tests for biodiversity indicators:

- Monotonicity test: all species go up >> indicator should go up
- Proportionality test: all species double >> indicator should double
- Identity test: all species indices in year X equal year 1 >> indicator equal

Additional test among others:

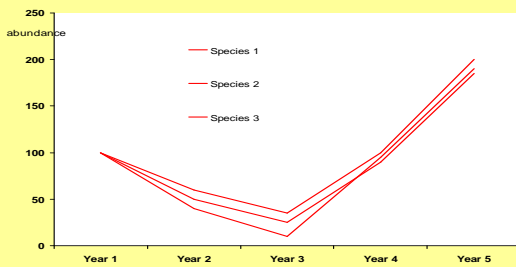
- base year invariance: changes in indicator should not be sensitive to base year chosen for the species

How do different indicators perform in these tests, such as traditional diversity indices (Simpson's index, Shannon index), Buckland's modified Shannon index and the geometric mean?

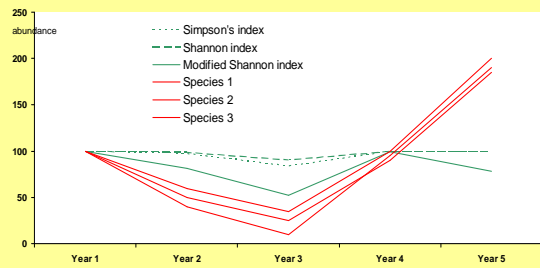
van Strien, A., L. Soldaat & R. Gregory, 2012. Desirable mathematical properties of indicators for biodiversity change. *Ecological Indicators* 14: 202-208.

Example: three species / similar behaviour over time / abundance in first year is 100

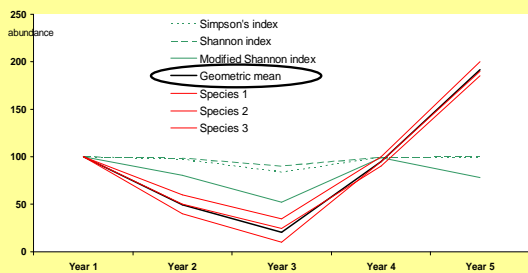
For any indicator, we expect first a decline and then an increase...



All three diversity indices do not mirror behaviour of the species
>> violate monotonicity and proportionality test



Geometric mean of indices mirrors changes in species appropriately
>> satisfies monotonicity and proportionality test.



Most indicators violate one or more tests

	Monotonicity	Proportionality	Identity	Base year invariance
Species richness	violate	violate		
Simpson's index	violate	violate		
Shannon index	violate	violate		
Modified Shannon	violate	violate		
% increasing - % declining sp. base year = first year		violate		
% increasing - % declining sp. base year = preceding year		violate	violate	
Arithmetic mean				violate
Geometric mean				
Sørensen similarity	violate	violate		

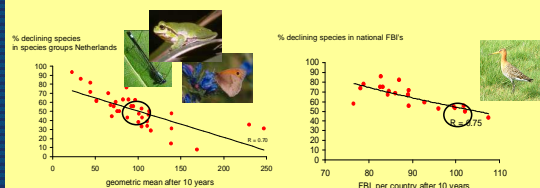
Conclusion: of all indicators considered the geometric mean performs best in the tests

Distance-to-target approach >> Martin Flade will discuss this

But what does the geometric mean of species indices tell us exactly?

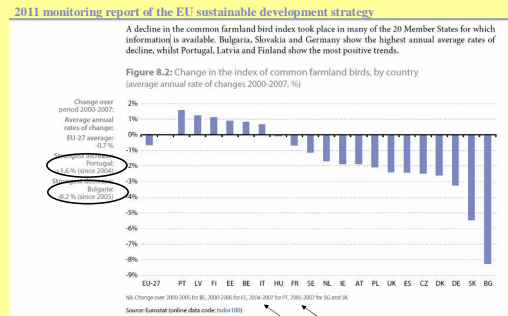
It responds to changes in the majority of species ("conservative"):

- When more species increase than decline >> indicator increases >> positive signal
- When more species decline than increase >> indicator declines >> negative signal
- When indicator remains 100 >> in practice species are not stable, but generally, 50% of species increases and 50% declines



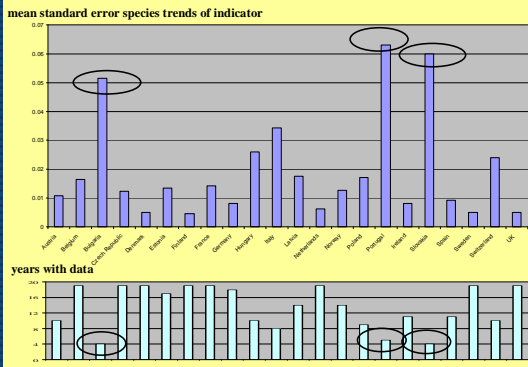
Geometric mean also accounts for magnitude of changes, to satisfy
 monotonicity & proportionality test
 >> indicator value 100 sometimes achieved even when more species
 decline than increase (or more species increase than decline)
 >> careful when applying the geometric mean to a few species

How to make sensible comparisons between countries?
 Comparison based on species classification developed by PECBMS

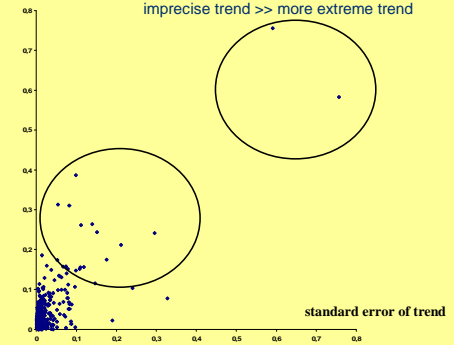


Benchmarking requires similar base years unequal base years?

Benchmarking requires taking into account uncertainty of indicators



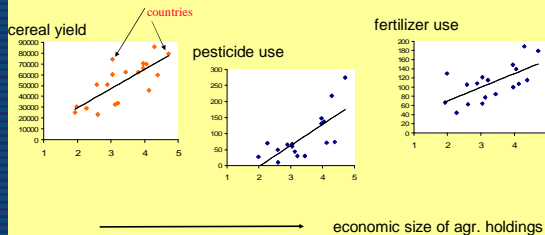
trend of species imprecise trend >> more extreme trend



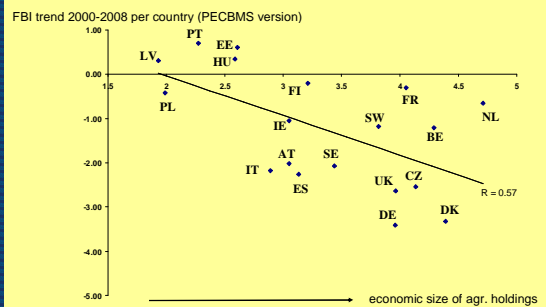
>> need to take into account confidence intervals for indicators

How to make sensible comparisons between countries?
 • absolute trends
 • trends accounted for economic intensity >> "Green Growth" indicator (transition to environmentally friendly economy)

agri-economic intensity e.g. average economic size of agricultural holdings per country (log of mean ESU/holding in 2007)

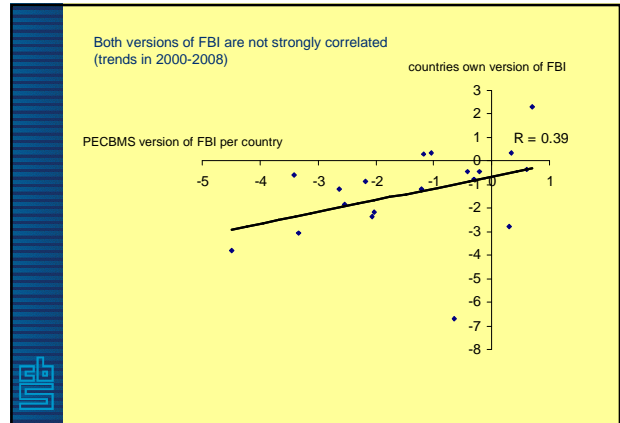


Bigger economic size >> stronger decline of farmland birds
 Big variation in decline



Complication: there are two versions of FBI per country

	countries have own version of FBI?	different species set?	different computation and/or data applied?
Austria	yes	yes	no
Belgium	no	no	no
Bulgaria	yes	yes	no
Czech	yes	yes	no
Cyprus	no	no	no
Denmark	yes	yes	no
Estonia	yes	yes	no
Finland	yes	yes	no
France	yes	yes	no
Germany	yes	yes	yes
Greece	no	no	no
Hungary	no	no	no
Italy	yes	yes	no
Ireland	yes	yes	no
Latvia	yes	yes	no
Netherlands	yes	yes	no
Norway	yes	yes	yes
Poland	yes	yes	no
Portugal	yes	yes	no
Slovakia	yes	yes	no
Slovenia	yes	yes	no
Spain	yes	yes	yes
Sweden	yes	yes	no
Switzerland	yes	yes	yes
UK	yes	yes	yes



How to deal with the two versions of FBI?

Countries own version of FBI's
 Strong point: better attuned to land use and inhabiting bird populations
 Weak point: lack of standardisation across countries/often expert judgement of species selection

PECBMS' version of national FBI's
 Weak point: less well attuned to land use & birds per country
 Strong point: better standardized in species choice

>> examine if PECBMS version can be adapted in order to improve benchmarking

Back to the debate questions ...

- How to aggregate species trends? **geometric mean performs best**
- Many species or important ones only? **many, to prevent risk of peculiar results**
- How to select species? **< to be considered later >**
- Weighing of species? by habitat preference? **< to be considered later >**
- How to make sensible comparisons between countries? **take into account confidence intervals / examine if PECBMS version can be adapted / develop green growth indicators**
- Has it a meaning all together? **geometric mean makes sense, but is a conservative measure / helpful to accompany it by additional ("satellite") indicators e.g. number of declining species or geometric mean of subsets of species**

Finally, one more lesson from historic debate on price indices

Even after > 100 years no "king-of-indices" found in price index theory. Nevertheless, price indices are widely used.

Keep searching for better indicators, but use indicators even if they are not yet perfect

THANK YOU