The following supplement accompanies the article

Integrated modelling of protein crop production responses to climate change and agricultural policy scenarios in Austria

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Supplement

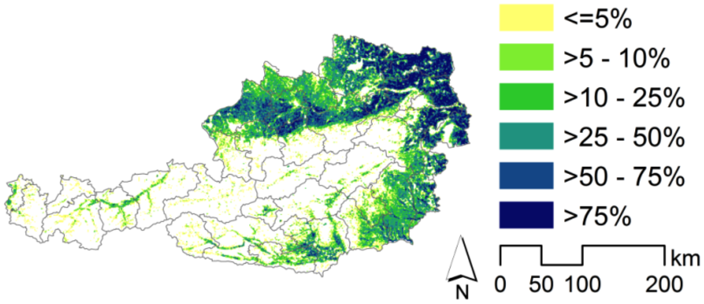

Fig. S1. Relative share of cropland within the 1 km grid cells. Cropland in white areas is not considered (see Stürmer et al. 2013).

Table S1. Crop-specific mean annual variable production costs, commodity prices, and labor requirements in hours.

Crop	Prices in €/t	Variable costs in €/ha	Labor in h/ha
alfalfa	75	374	44
alsike clover	75	433	44
durum wheat	220	365	11
faba bean	142	399	9
fallow*	332	121	5
field pea	141	352	9
grain maize	131	442	17
oats	111	305	11
potato	95	2200	44
red clover	75	433	44
silage maize	26	549	13
soybean	275	405	8
spring barley	118	338	11
sugar beet	28	978	19
sunflower	232	468	9
timothy	75	466	44
triticale	110	347	11
vegetables	167	1876	58
winter barley	118	368	11
winter rape	300	354	10
winter rye	130	329	11
winter wheat	138	380	11

Note: Commodity prices represent the mean of the period 2007-2009 (Statistics Austria 2013b).
* A set aside premium of 332 €/ha is considered.
Labor hours are valued with 10 €/h.
Variable production costs include costs for seeds, herbicides, fungicides and pesticides, fuel and electricity, costs of repair and insurances. They apply for rain-fed and irrigated crop production and are taken from the standard gross margin catalogue (BMLFUW 2008) and from other data sources.

Fertilizer costs for nitrogen and phosphorus are calculated by multiplying the input demands simulated in EPIC at 1 km grid level by a fixed nitrogen (1.1 €/kg) and phosphorus price (1.6 €/kg), respectively.
Annualized capital costs for irrigation systems amount to 213 €/ha. 1.11 labor hours per hectare are required to set up and run the system per irrigation activity, where a maximum of 50 mm of water is applied to the cropland. The number of irrigation activities per hectare and year is calculated by dividing the total irrigation amount simulated in EPIC at 1 km grid level by the maximum irrigation amount. The duration of irrigation is calculated by dividing the irrigation amount in m³/ha by the water application rate per hour, which is 60 m³/ha. Electricity costs for irrigation are determined by multiplying the duration of irrigation by the electricity consumption of 12 kWh and the average annual electricity price of 0.065 €/kWh (Heumesser et al. 2012).

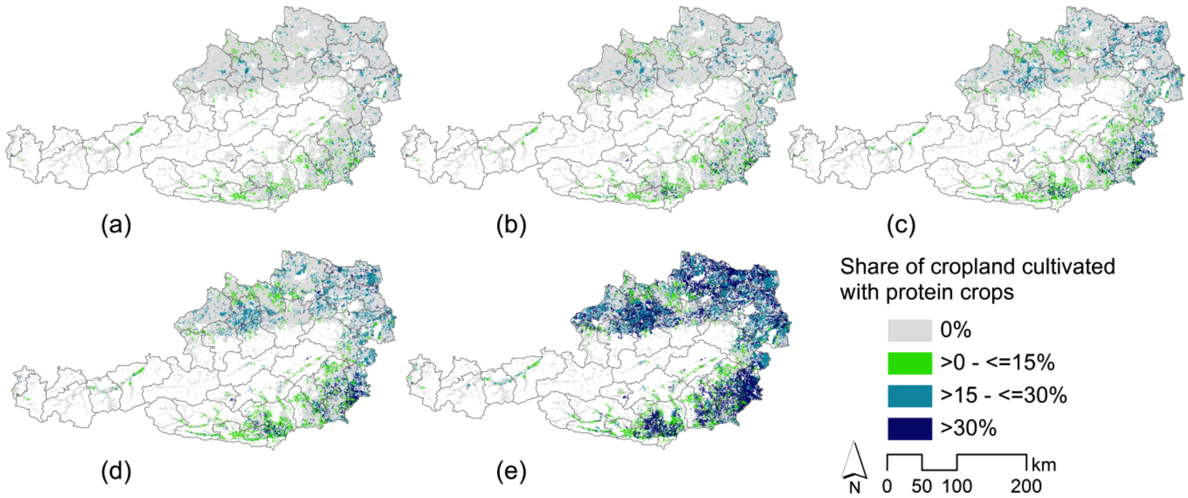

Fig. S2. Relative shares of protein crops on cropland at five levels of marginal opportunity costs in climate change scenario REF and policy scenario 'no AEP'.
Notes: Maps show five levels of marginal opportunity costs in expanding protein crop production and the associated shares of protein crops on cropland, i.e. 19 €/t (a), 117 €/t (b), 203 €/t (c), 303 €/t (d), 637 €/t (e). Cropland in white areas is not considered. Administrative boundaries (NUTS 3) are shown for better orientation.

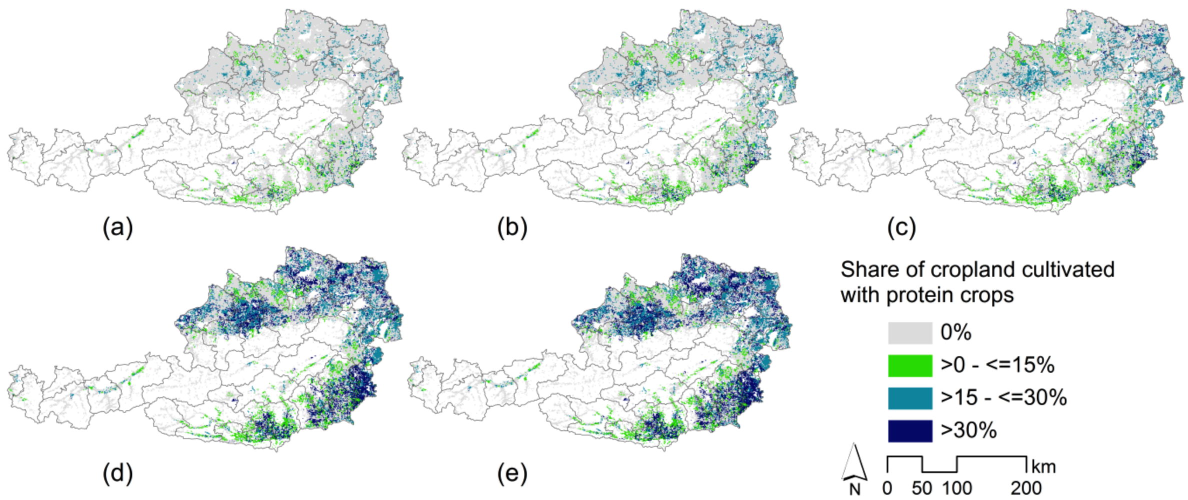

Fig. S3. Relative shares of protein crops on cropland at five levels of marginal opportunity costs in climate change scenario WET and policy scenario ‘DP-AEP’.
Notes: Maps show five levels of marginal opportunity costs in expanding protein crop production and the associated shares of protein crops on cropland, i.e. 19 €/t (a), 117 €/t (b), 196 €/t (c), 296 €/t (d), 643 €/t (e). Cropland in white areas is not considered. Administrative boundaries (NUTS 3) are shown for better orientation.

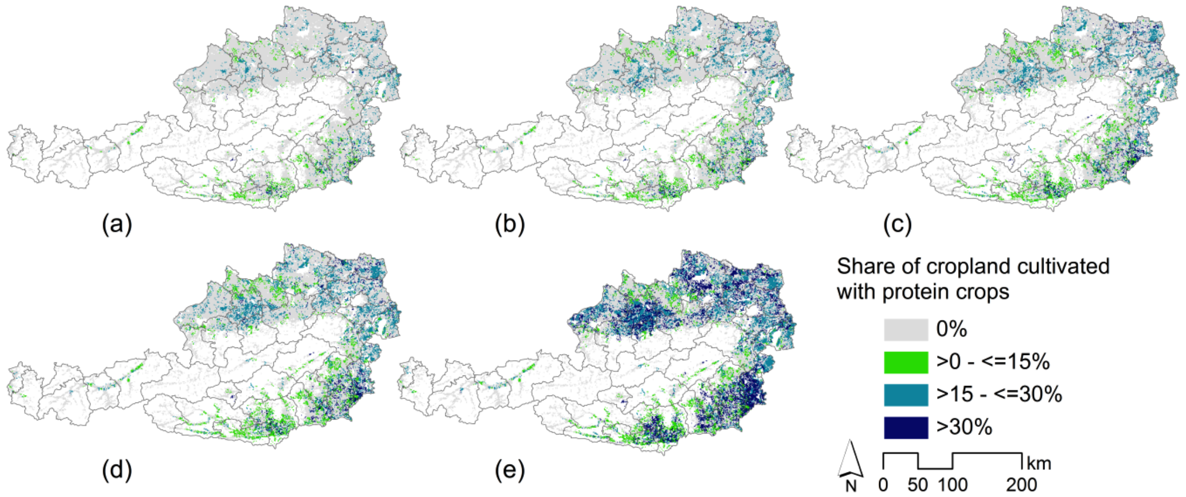

Fig. S4. Relative shares of protein crops on cropland at five levels of marginal opportunity costs in climate change scenario DRY and policy scenario 'DP-AEP'.

Notes: Maps show five levels of marginal opportunity costs in expanding protein crop production and the associated shares of protein crops on cropland, i.e 19 €/t (a), 115 €/t (b), 194 €/t (c), 291 €/t (d), 647 €/t (e). Cropland in white areas is not considered. Administrative boundaries (NUTS 3) are shown for better orientation.

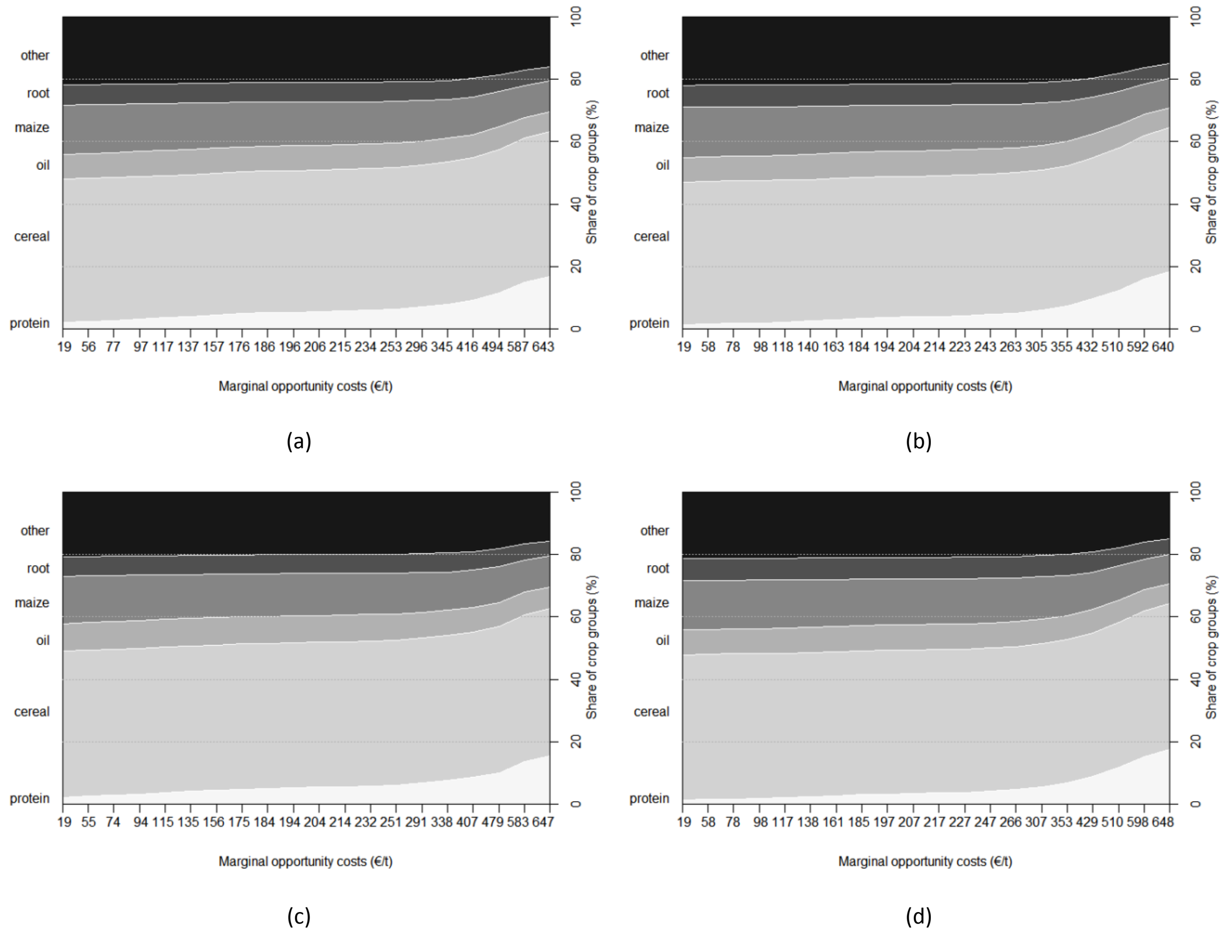

Fig. S5. Relative shares of six crop groups on cropland by marginal opportunity costs of expanding protein crop production in climate change scenario WET and policy scenarios 'DP-AEP' (a) and 'no AEP' (b) as well as in climate change scenario DRY and policy scenarios 'DP-AEP' (c) and 'no AEP' (d) in Austria.

Note: Crop groups include protein crops, cereals, oil crops, maize, root crops and others.

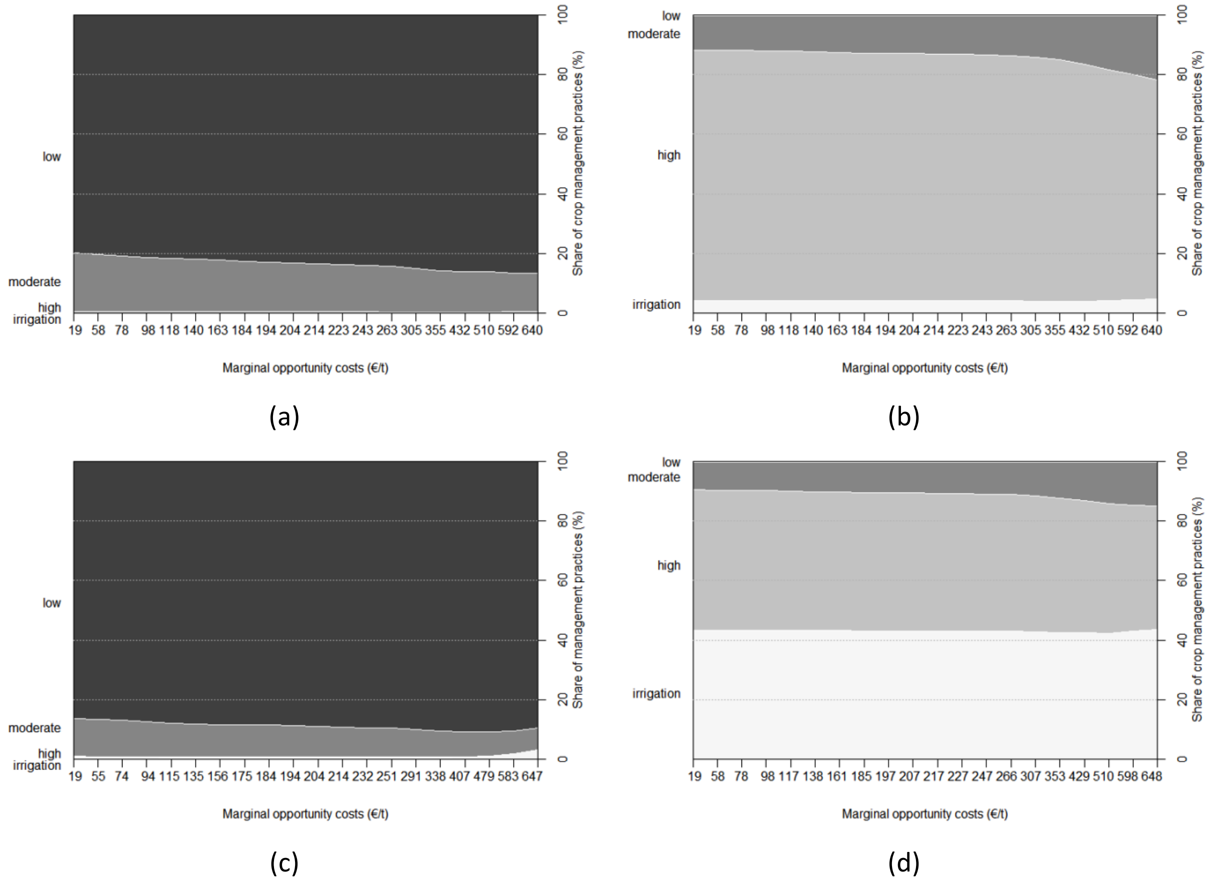

Fig. S6. Relative shares of crop management practices on cropland by marginal opportunity costs of expanding protein crop production in climate change scenario WET and policy scenarios ‘DP-AEP’ (a) and 'no AEP' (b) as well as in climate change scenario DRY and policy scenarios ‘DP-AEP’ (c) and 'no AEP' (d) in Austria.
Note: Crop management practices include high fertilization intensity on irrigated cropland as well as high, moderate, and low fertilization intensity on rain-fed cropland.

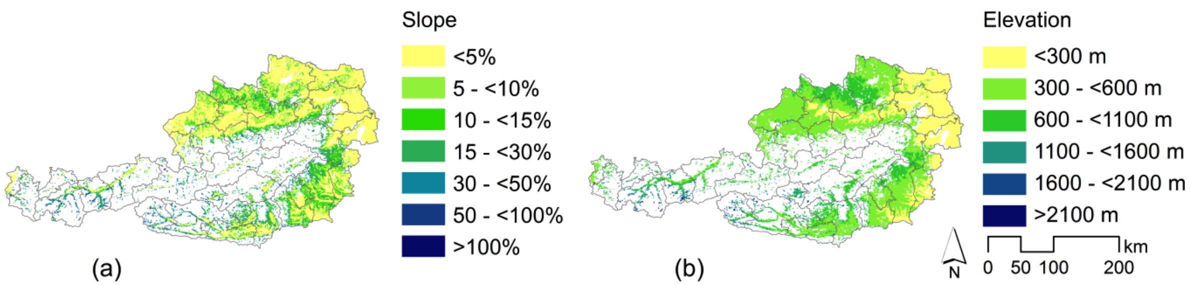

Fig. S7. Slope (a) and elevation (b) of cropland grid cells.
Notes: Cropland in white area is not considered. Administrative boundaries (NUTS 3) are shown for better orientation.

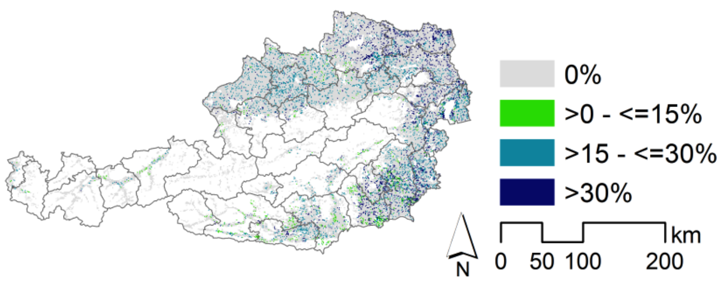

Fig. S8. Relative shares of set aside land in the historical period (1975-2005).
Notes: Cropland in white area is not considered. Administrative boundaries (NUTS 3) are shown for better orientation.