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Speed Science

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Climate Change Impacts on Ag. Land Use Decisions in PNW

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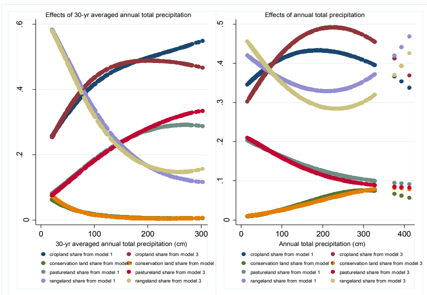

Fig. 1 Impacts of total precipitation on agricultural land uses

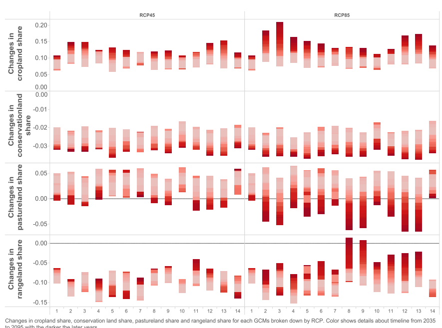

Fig.2 Future land use changes under future climates

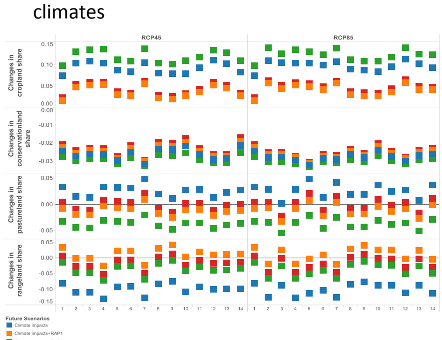

Fig.3 Future land use changes by 2050 under future climates and RAPs

In this study, we first examine how historical climate and weather conditions affect agricultural land use shares using a Fractional Multinomial Logit (FMLOGIT) model, then predict land use shares under future climates from 14 Global Climate Model (GCM) projections for two emission scenarios (RCP4.5 and RCP8.5) and three Representative Agricultural Pathways (RAPs). Five land use activities are considered in the FMLOGIT model, including cropland, conservation land, pastureland, rangeland and woodland.

Here are some summaries: (1) Both long-term climate and short-run weather variables are important when making land use decisions (see the table below);(2) There is a nonlinear relationship between total precipitation (short-run and long-run) and agricultural land uses, suggesting a certain amount of precipitation is beneficial for crop growth but is harmful when it is beyond a certain threshold (see **Fig.1**); (3) Cropland and pastureland shares are increasing with declines in rangeland and conservation land shares at the early period under future climates. However, as changes in climate become more significant, cropland share increases more while pastureland increases less as time goes by (see **Fig.2**); (4)Changes in future agricultural land use vary under different RAPs (see **Fig.3**);(5) Competitions among agricultural land uses under RCP8.5 are more spread out due to larger variation of changes in temperature and precipitation (**Fig.2 & Fig.3**)

Variable	Cropland		Conservation land		Pastureland		Rangeland	
	APE	ELS	APE	ELS	APE	ELS	APE	ELS
RS_{ct}	0.1589***	0.26	0.0046	0.13	-0.0704***	-0.28	-0.0974***	-0.17
	(0.0380)		(0.0050)		(0.0271)		(0.0363)	
RS_{lt}	-0.0903**	-0.12	-0.0069	-0.16	-0.0307	-0.10	0.1441***	0.21
	(0.0360)		(0.0068)		(0.0268)		(0.0368)	
RS_{gt}	0.4763	0.02	0.3212***	0.27	-0.5385**	-0.06	-0.2101	-0.01
	(0.4788)		(0.0509)		(0.2722)		(0.4737)	
D_inc	-0.8184	-0.26	0.0751	0.42	-0.6173**	-0.48	1.4080***	0.48
	(0.5687)		(0.0760)		(0.2559)		(0.5190)	
D_pop	0.0003**	0.06	0.0000	-0.03	-0.0001	-0.03	-0.0002	-0.04
	(0.0002)		(0.0000)		(0.0000)		(0.0002)	
Z_land	-0.0247**	-0.28	-0.0029**	-0.55	0.0087**	0.23	0.0208**	0.25
	(0.0112)		(0.0012)		(0.0043)		(0.0093)	
Z_mach	0.4437***	0.60	0.0307***	0.71	-0.2454***	-0.80	-0.1726***	-0.25
	(0.0818)		(0.0088)		(0.0464)		(0.0666)	
T_ppt	0.0014**	0.52	-0.0005***	-2.33	0.0010***	1.11	-0.0021***	-1.02
	(0.0006)		(0.0001)		(0.0003)		(0.0007)	
T_ddays	-0.0380	-0.15	0.0003	2.02	0.0129	0.42	0.0445	0.11
	(0.0438)		(0.0090)		(0.0210)		(0.0443)	
T_p95r	-0.0838	-0.05	-0.2434***	-2.28	0.3754	0.50	-0.1035	-0.06
	(0.7386)		(0.0747)		(0.3779)		(0.8275)	
R_lppt	0.0003	0.26	0.0004***	1.63	-0.0004**	-0.34	-0.0005*	-0.31
	(0.0003)		(0.0001)		(0.0002)		(0.0003)	
R_lp95r	0.0618	0.03	-0.0729***	-0.67	-0.0187	-0.02	0.0540	0.03
	(0.0959)		(0.0135)		(0.0430)		(0.0957)	
irr	0.4237***	0.19	0.0062	0.05	-0.1088**	-0.12	-0.2714**	-0.13
	(0.1080)		(0.0134)		(0.0540)		(0.1202)	
Soil variables	Y		Y		Y		Y	
Predicted value	0.40		0.02		0.16		0.38	

Note: Robust standard errors of average partial effects (APEs) are in parentheses; elasticities (ELS) are calculated at sample means; * p<0.1, ** p<0.05, and *** p<0.01, respectively

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