



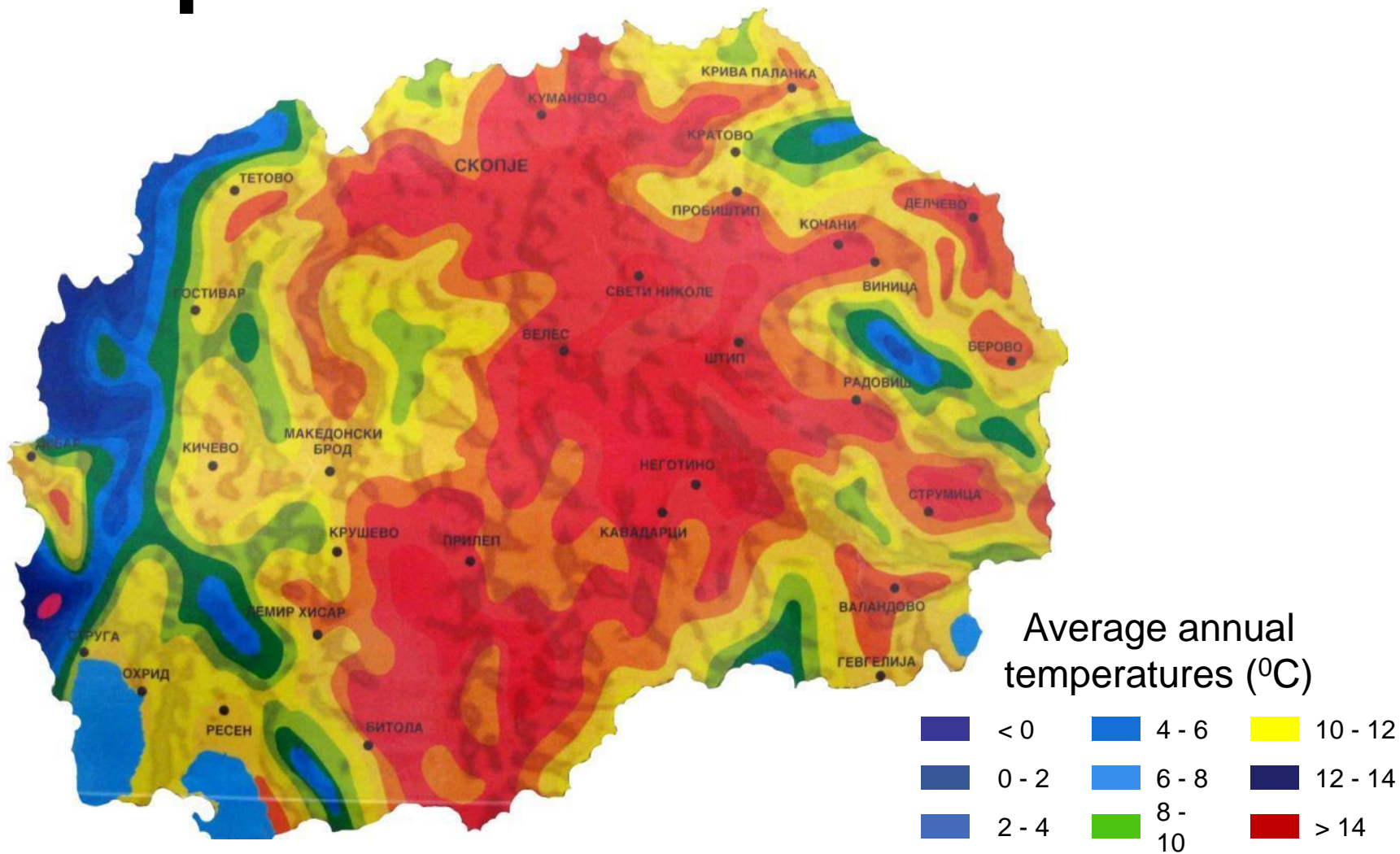
# Climate change and the impact on agriculture in Republic of Macedonia

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Vasko Zlatkovski

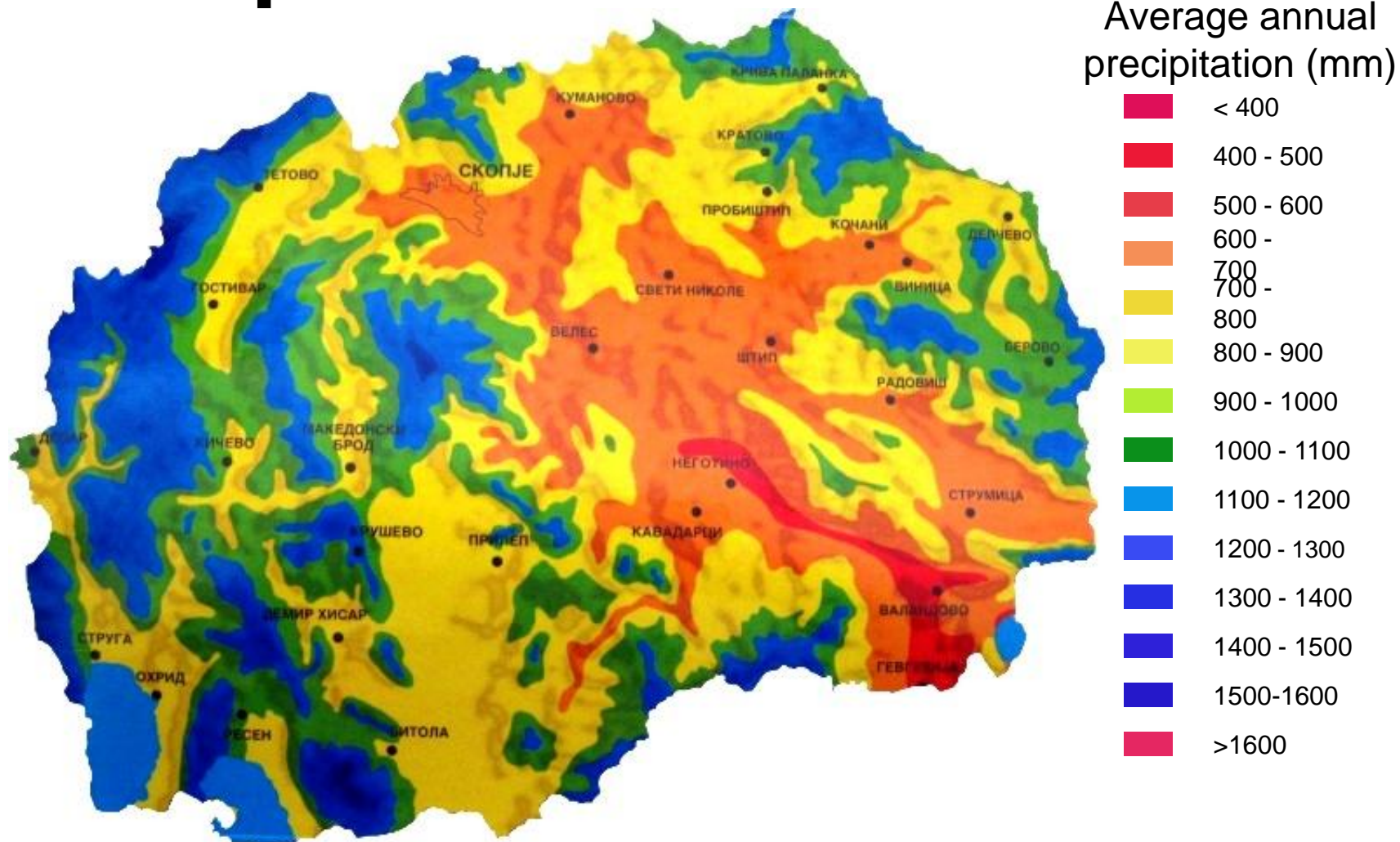
# Republic of Macedonia – facts



# Temperature



# Precipitation

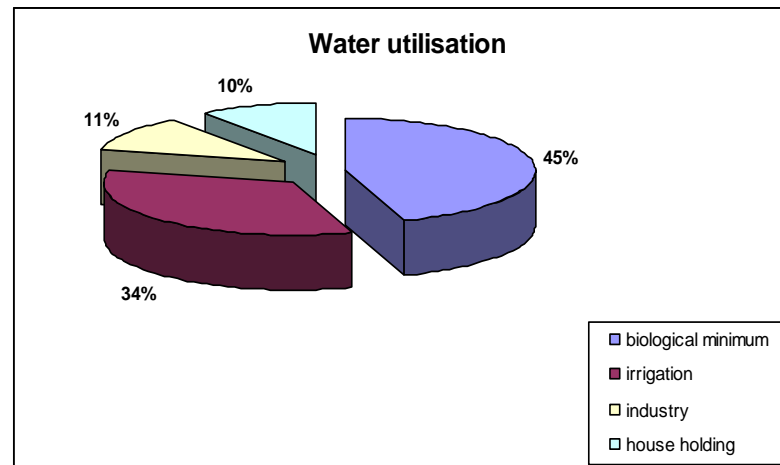
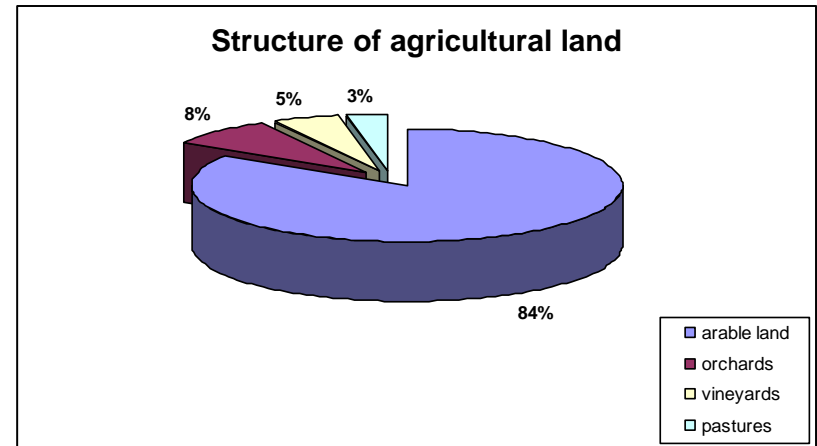
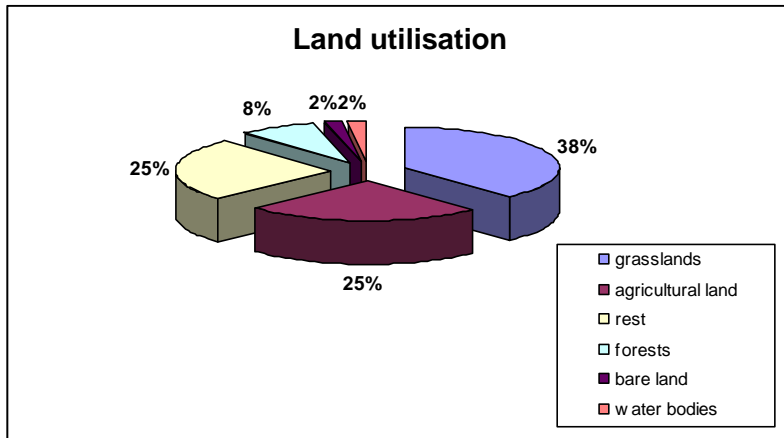




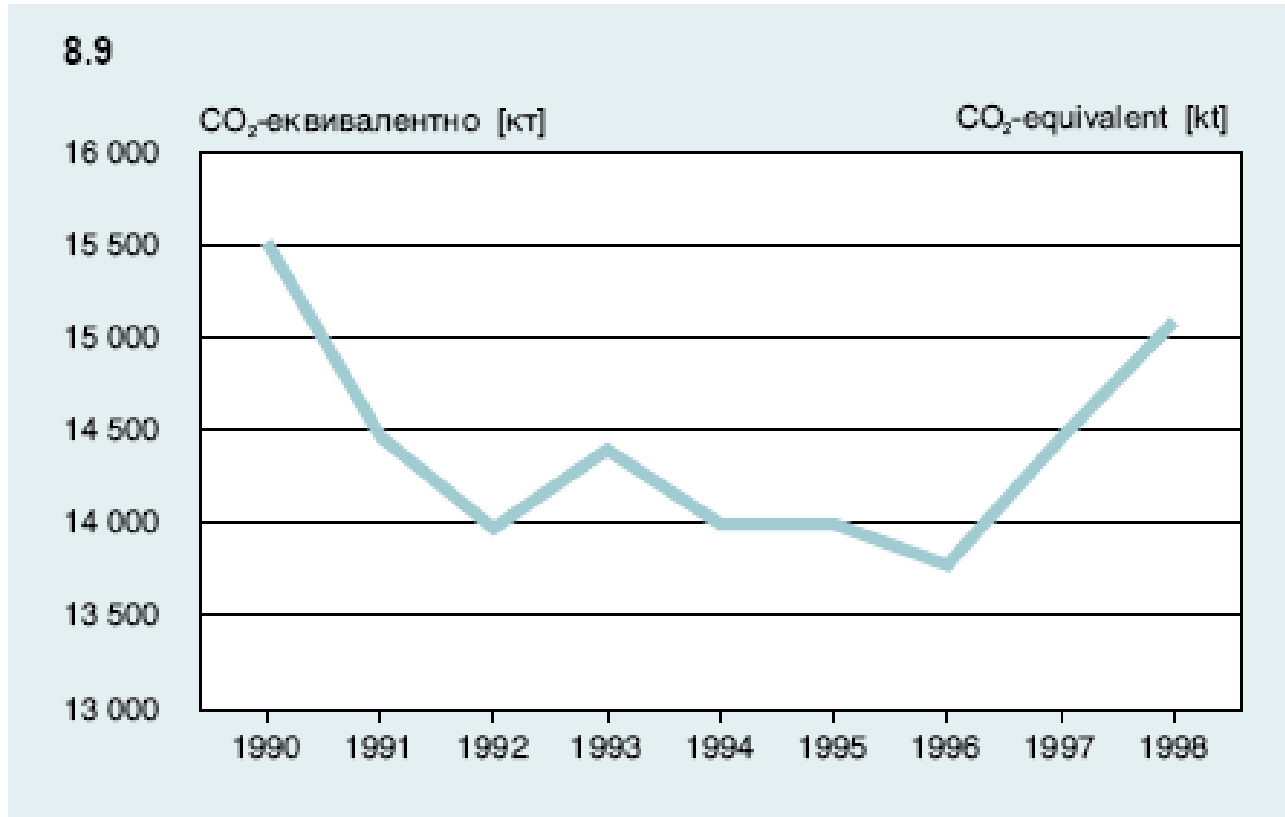
# Climate conditions

- **Sub-mediterranean zone (20 - 500 m)**
- **Moderate continental sub mediterranean zone (up to 600 m)**
- **Hot continental zone (600 – 900 m)**
- **Sub-highlands continental mountain zone (1100 – 1300 m)**
- **Highlands continental mountain zone (1300 – 1650 m)**
- **Sub-alipne mountain zone (1500 – 2250 m)**
- **Alpine mountain zone (> 2250 m)**

# Agriculture in Macedonia – facts

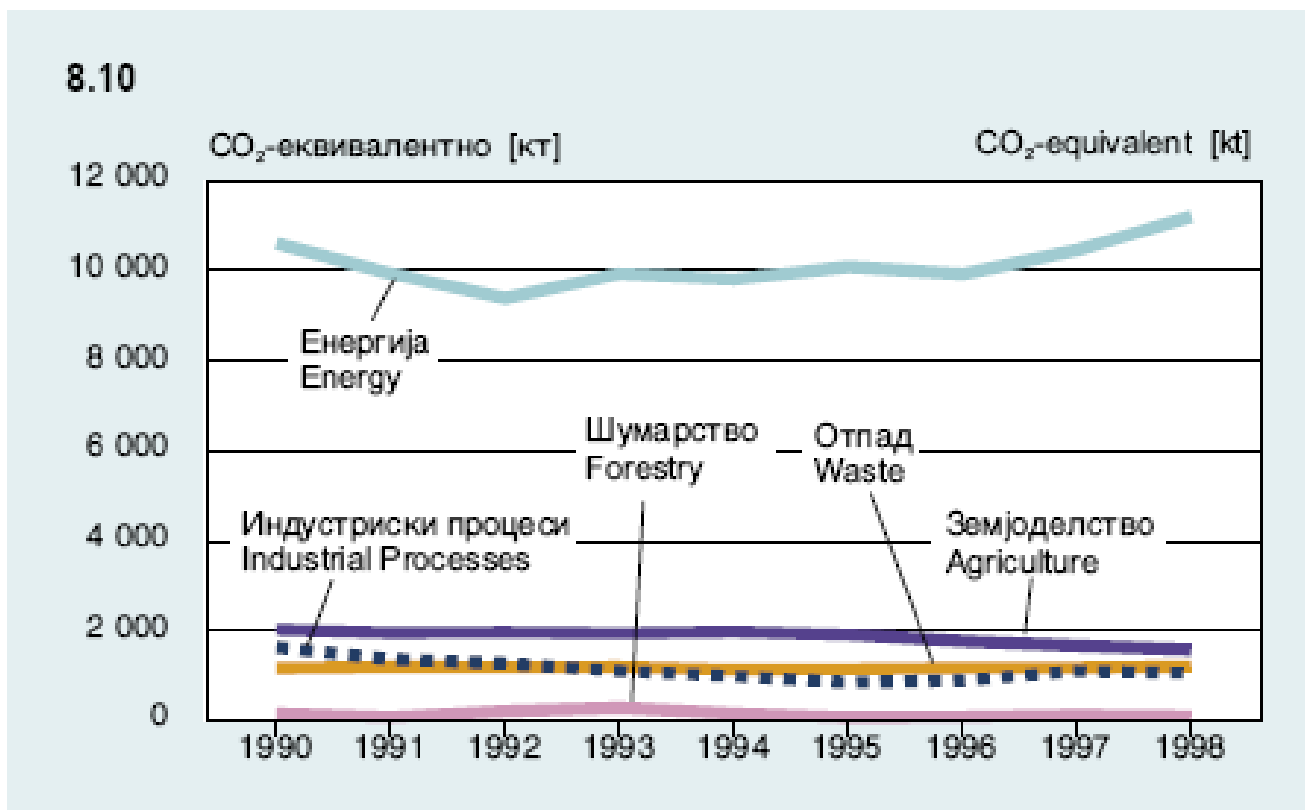


# Agriculture & climate change



Source: Ministry of Environment and Physical Planning

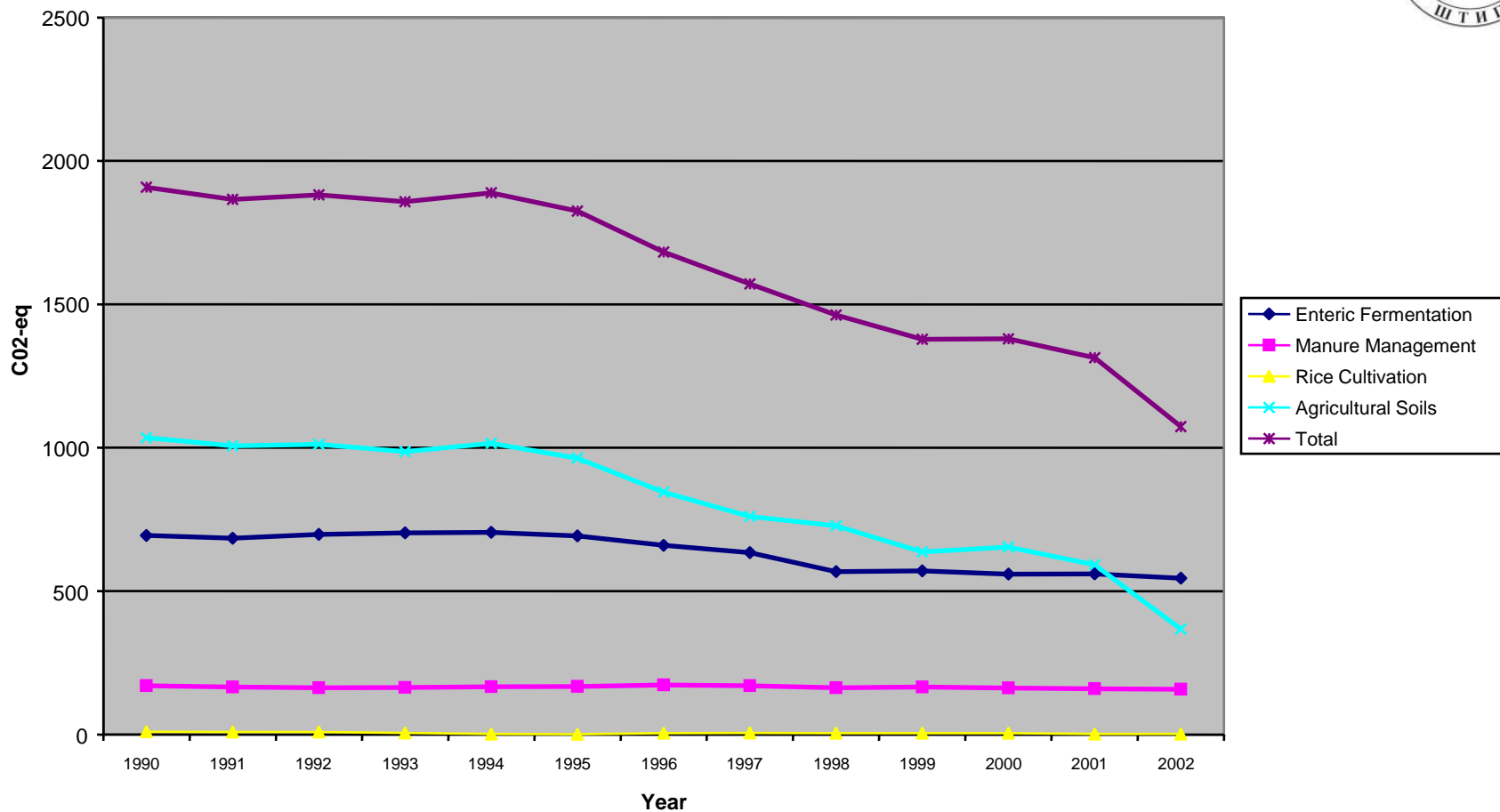
Total emission of gasses in Republic of Macedonia (1990 – 1998)



Source: Ministry of Environment and Physical Planning

## Emission of gasses by sector in Republic of Macedonia (1990 – 1998)





Agriculture related greenhouse gas emission in Republic of Macedonia (1990 – 2002)



# Agricultural subsectors and climate change

Analysis of three sub-sectors related to climate change:

1. Agricultural crops
2. Soils
3. Animal husbandry



# Agricultural crops

- The most vulnerable zone
  - Central Vardar valley – region of Povardarie
    - valley of river Crna
    - river Bregalnica
- Very susceptible zones
  - South-eastern part of the country
  - Southern Vardar valley
  - Skopje-Kumanovo valley
  - Ovche Pole
- Less susceptible zones
  - Pelagonija
  - Polog
  - Perspa/Ohrid region



# The most affected crops

- **Grapevines** – in the Povardarie region
- **Tomato** – in the southeastern part of the country (Strumica – Gevgelija)
- **Winter wheat** – in Skopje-Kumanovo region & Ovce Pole
- **Apple** – in the Prespa/Ohrid region
- **Alfalfa** – in all agricultural regions of the country, especially in the region of Bitola



Area	Culture	2025	2050	2075	2100
Kavadarci	Grapevine	46	50	55	59
Gevgelija	Tomato	<b>75</b>	<b>78</b>	<b>81</b>	<b>84</b>
Strumica	Tomato	<b>72</b>	<b>75</b>	<b>79</b>	<b>82</b>
Stip	Winter wheat	14	17	21	25
Skopje	Winter wheat	8	12	16	21
Bitola	Alfalfa	<b>58</b>	<b>62</b>	<b>66</b>	<b>70</b>
Resen	Apple	46	50	55	59

Expected yield decrease as result of influence of climate changes (in %)

# Map of vulnerable zones





# Adaptation measures

- Agriculture where irrigation is applied
  - Extension of techniques for water saving during irrigation.
  - Maintenance or enlargement of irrigated areas with same amount of water.



# Adaptation measures

- Rainfed agriculture:
  - Genetic and breeding measures
  - Application of meliorative measures
  - Improvement of agritechnical measures
  - Improvement of irrigation
  - Improvement of knowledge of farmers
  - Raising public awareness for new techniques of adaptation



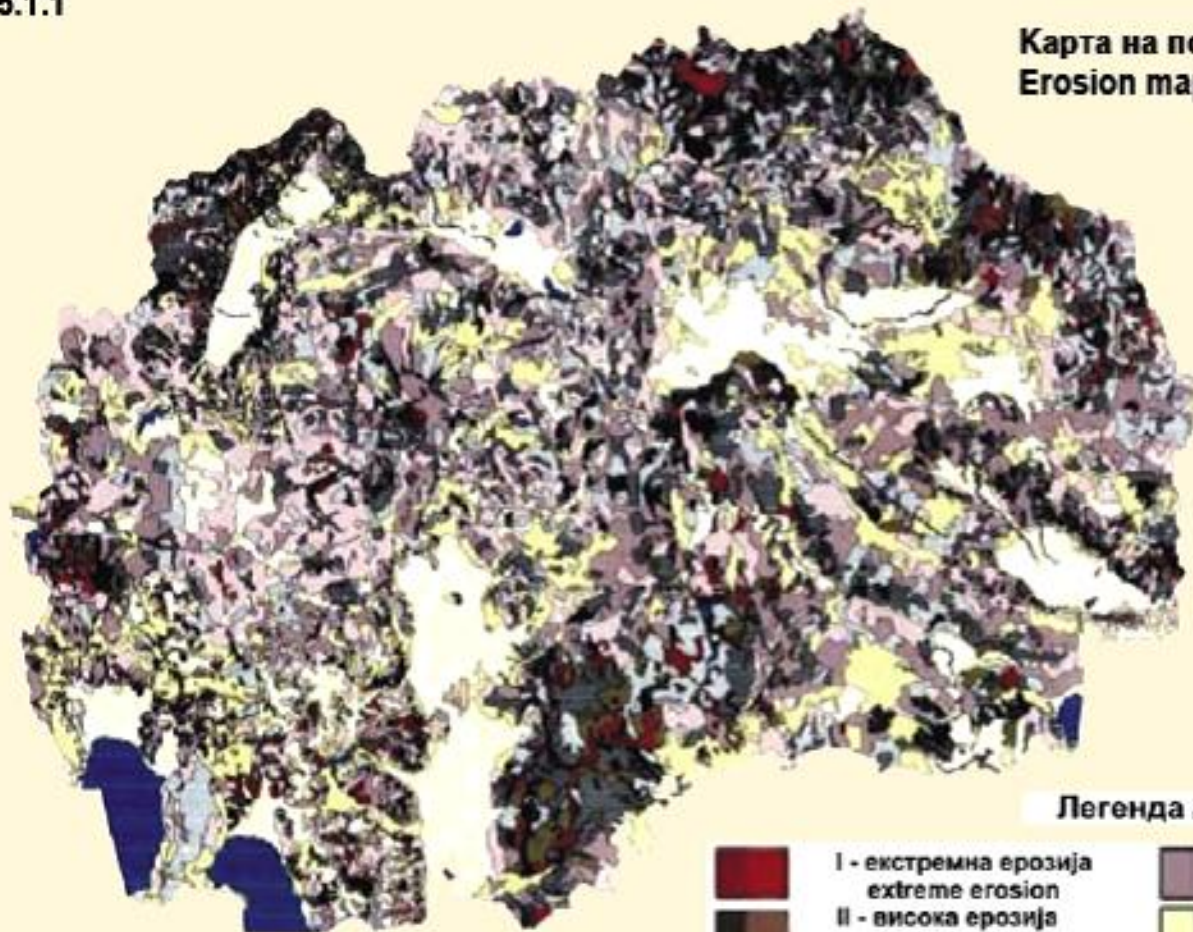


# Soil organic matter & adaptation measures

- Application of organic manures
- Fertilization based on agrichemical analysis
- Introduction of legume crops
- Crop rotation
- Land conservation

## Карта на почвената ерозија Erosion map

M=1:200 000



### Легенда / Legend

	I - екстремна ерозија extreme erosion		IV - слаба ерозија low erosion
	II - висока ерозија high erosion		V - многу слаба ерозија very low erosion
	III - средна ерозија medium erosion		зони на седиментација zones of sedimentation

Source: Ministry of Environment and Physical Planning



# Soil erosion & adaptation measures

- Afforestation
- Introduction of new irrigation techniques
- Raising farmers' awareness for proper land management

# Soil salinisation & adaptation measures



- Improvement of hydrological condition of the valleys
- Drainage of microdepressions in valleys
- Introduction of new irrigation techniques
- Irrigation with small and exact quantities of water



# Animal husbandry

- Direct influence
  - Increased heat stress – decreased productivity of domestic animals
  - Especially vulnerable are highly productive modern breeds



# Animal husbandry

- Indirect influence
  - Decrease of forage production
  - Introduction of new diseases



# Animal husbandry & adaptation measures

- Determination of suitable regions for animal breeding
- Identification and introduction of resistant breeds to high temperatures and diseases
- Introduction of specific feed schedule
- New skills and knowledge on farmer level and institutional level
- Support of research programmes towards improvement of animal genetic resources
- Dissemination of results and raising public awareness



# CONCLUSION

- The Macedonian agriculture will be significantly affected by the global climate change.
- The most affected crops will be grapevines, tomatoes and alfalfa.
- Effects on soils and animal husbandry.
- Adaptation measures rather than combating global climate change.
- Necessity of raising public awareness on different levels.