

# The Integration of Nature Protection into Environmental Wind Farm Assessment Procedures in Croatia

Mirna Mazija<sup>1</sup>, Zrinka Domazetović<sup>2</sup>, Loris Elez<sup>2</sup>, Blandina Randić Potkonjak<sup>2</sup>, Hrvojka Šunjić<sup>3</sup>

<sup>1</sup>OIKON Ltd. Institute for Applied Ecology, mmazija@oikon.hr

<sup>2</sup>Ministry of Culture, Directorate for Nature Protection; zrinka.domazetovic@min-kulture.hr, loris.elez@min-kulture.hr, blandina.randic-potkonjak@min-kulture.hr

<sup>3</sup>APO Ltd. Environmental Services, hrvojka.sunjic@apo.hr

## INTRODUCTION

The Republic of Croatia has an area of 87,661 km<sup>2</sup>, with 56,594 km<sup>2</sup> of land surface. The territory is organised into 21 counties. Due to specific geographical position between several biogeographic regions and diverse ecological, climatic and geomorphological conditions, Croatia is one of the richest European countries in terms of biodiversity<sup>[1]</sup>.

There is an increasing trend towards shifting away from conventional energy production forms to new renewable energy sources (RES), due to the current energy crisis, environment pollution and climate change issues. However, controversial issues have arisen with regard to impact of RES on biodiversity<sup>[2]</sup>.

Energy Development Strategy of the Republic of Croatia sets out the goal to reach 9 to 10% of wind generated electricity in overall electricity consumption by 2020, with the estimated installed power of 1,200 MW<sup>[3]</sup>. At present, wind farms in Croatia produce 87,8 MW of energy. But the increasing number of wind farms presents a potential threat to biodiversity, especially to certain bird species and bats.

## RESULTS AND DISCUSSION

The beginning of wind farm development in Croatia, starting in 2000, coincided with the accession to international agreements in the field of nature conservation and the transposition of Bird and Habitats Directives into national legislation in the process of EU accession, which led to stricter requirements on nature protection. Therefore, development of nature protection standards can be analysed by reviewing the wind farm impact assessment procedures conducted from 2000 until 2010.

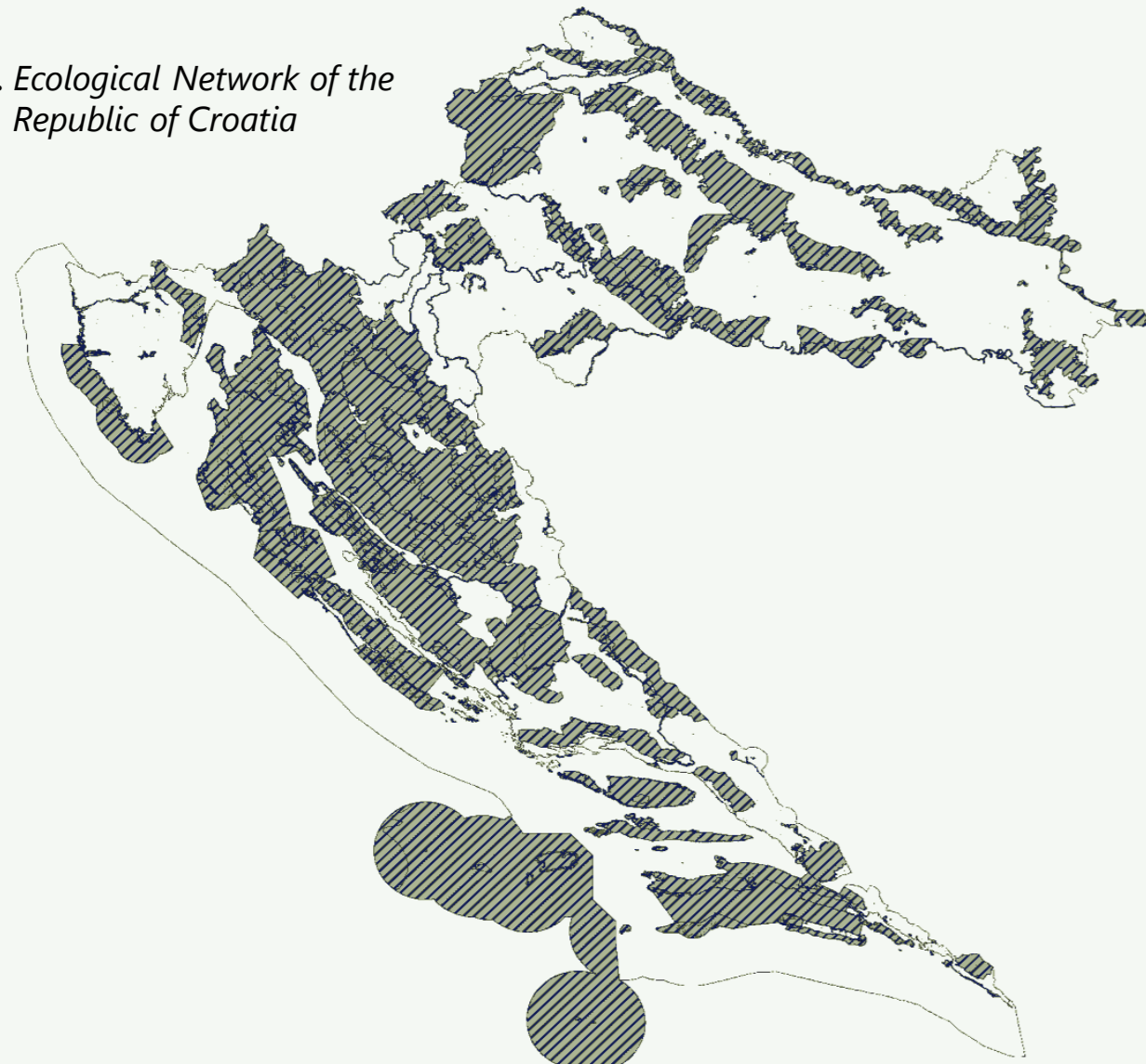
The selection of potential locations for wind farms in physical plans has mainly been based on the wind potential of specific locations, and no account has been taken of the cumulative effects of installation of a substantial number of wind farms in a certain area<sup>[2]</sup>. Wind farm development in Croatia is mostly concentrated in the hinterland of the Adriatic Sea, because of the mountain ridges and isolated exposed areas, which ensure high average wind speeds and maximum energy capture (Picture 1). No Strategic Environmental Assessment (SEA) for wind farm development plans has ever been carried out. Seven counties have wind farms foreseen in their physical plans, at altogether 107 locations (Table 1 & Picture 2). In 4 counties physical plans have provisions that enable wind farm development but locations should be defined by city/municipality plans, in 2 counties only small scale projects of renewable energy use are foreseen and physical plans in 8 counties have no wind farms planned.

In the beginning, only the EIA was conducted, so the impact on biodiversity and landscape was being assessed in the scope of the EIA. In 2007, 47% of land territory was proclaimed as the Ecological Network of the Republic of Croatia<sup>[5]</sup> (Picture 3), and since then the AA is mandatory if a planned wind farm project could have a significant impact on the conservation objectives of a certain ecological network site. AA is carried out as part of the EIA procedure.

Until the end of 2010 the EIA procedure was conducted for 47 wind farm projects (Table 2). Six wind farms and a test field with one wind generator prototype have been constructed, 33 wind farm projects were found acceptable in the EIA procedure and 4 were rejected (Picture 1 & Table 1). Other 138 wind farm projects were entered into the RERCPPP Registry of projects that have had (prior) energy approval regulating the conditions and possibilities to use renewable energy sources (Picture 1 & Table 1 and 3).

The most significant progress happened with the assessment of impact of wind farms on birds and bats (Table 4). First EIA procedures did not require bird- or bat- pre-construction field surveys on the location of the wind farm project, and no monitoring of the impact was required. Afterwards, monitoring of impact after completing the construction became a requirement, first only for birds and later also for bats. At the later phase, following the guidelines and requirements of nature and environmental protection authorities<sup>[6]</sup> <sup>[7]</sup>, field surveys to assess the potential impact of planned wind farms on birds and bats became a standard. Field surveys of birds and bats need to include the full annual cycle of activity. Depending on the findings of the filed survey, general and specific mitigation measures for birds and bats are being prescribed in the EIA procedures. Duration of prescribed monitoring after construction went from 1 to 2 years.

Picture 3. Ecological Network of the Republic of Croatia



Picture 2. Wind turbines in county physical plans, RERCPPP Registry, with approved EIA/AA and built

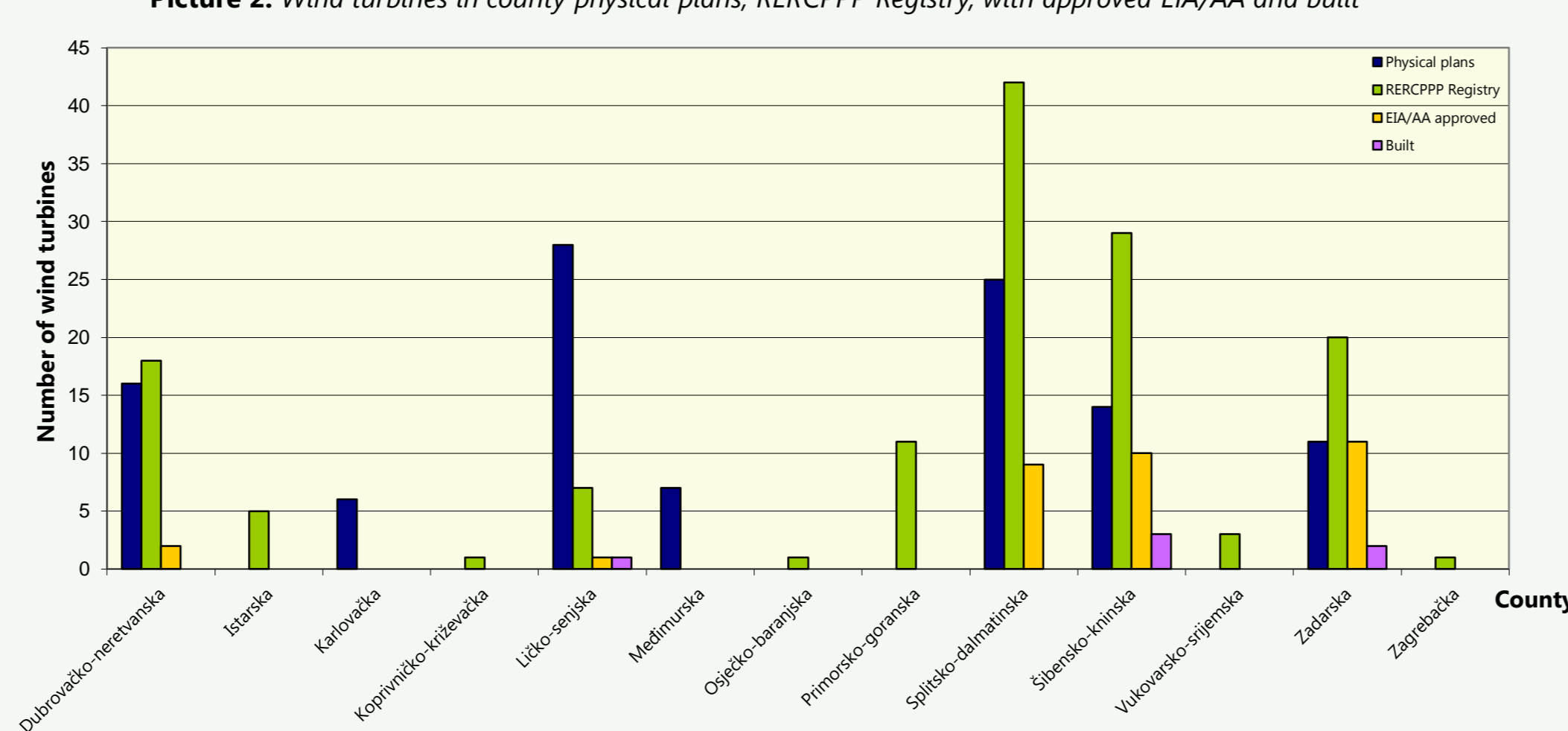


Table 1. Status of wind turbine projects per county

County	County physical plans		RERCPPP Registry		EIA/AA				No. of built wind farms and electrical capacity (MW)
	No. of wind farm locations	No. of wind farm projects	Electrical capacity (MW)	No. of acceptable projects (No.a.P.)	No. of projects in procedure	No. of rejected or unacceptable projects	No. of wind turbines for a.P.	Electrical capacity (MW) for a.P.	
Bjelovarsko-bilogorska	0	0	0,00						
Brodsko-posavska	0	0	0,00						
Dubrovačko-neretvanska	16	18	800,50	2	1	1	51	119	
Grad Zagreb	0	0	0,00						
Istarska	0	5	211,65		1				
Karlovačka	6	0	0,00						
Koprivničko-križevačka	0	1	24,00						
Krapinsko-zagorska	0	0	0,00						
Ličko-senjska	28	7	705,00	1			22	66	1 (42)
Međimurska	7	0	0,00						
Osječko-baranjska	0	1	40,00						
Požaško-slavonska	0	0	0,00						
Primorsko-goranska	0	11	396,20			1			
Sisačko-moslavačka	0	0	0,00						
Splitsko-dalmatinska	25	42	1.536,90	9	2	1	135	266,4	
Šibensko-kninska	14	29	1.132,00	10	2	1	223	411	3 (30)
Varaždinska	0	0	0,00						
Virovitičko-podravska	0	0	0,00						
Vukovarsko-srijemska	0	3	146,00						
Zadarska	11	20	1.135,21	11	4		135	287,4	2 (14,8)
Zagrebačka	0	1	36,00						
<b>Total</b>	<b>107</b>	<b>138</b>	<b>6163,46</b>	<b>33</b>	<b>10</b>	<b>4</b>	<b>566</b>	<b>1149,8</b>	<b>6 (86,8)</b>

## MATERIALS AND METHODS

In our study we have analysed the data on wind farm projects in Croatia entered into the Registry of Renewable Energy Resource and Cogeneration Projects and Privileged Producers (RERCPPP Registry)<sup>[4]</sup>, wind energy utilization options determined by county spatial plans, available data on Environmental Impact Assessment (EIA) and Appropriate Assessment (AA) procedures for wind farm projects conducted until the end of 2010, number of wind turbines and electrical capacity, presence of bird- and bat-surveys in the EIA and AA studies and development of mitigation measures and monitoring obligations from the first wind farm project in 2000 until the end of 2010. Results are presented as tables and graphs made in Microsoft Excel 2007. Map of operational wind farms, wind farm projects, for which the EIA procedure has been finished, and wind farm projects in the RERCPPP Registry and map of the Ecological Network have been made in ArcMap 9.1 and ArcView GIS 3.3.

Picture 1. Map of the Republic of Croatia with wind farm locations

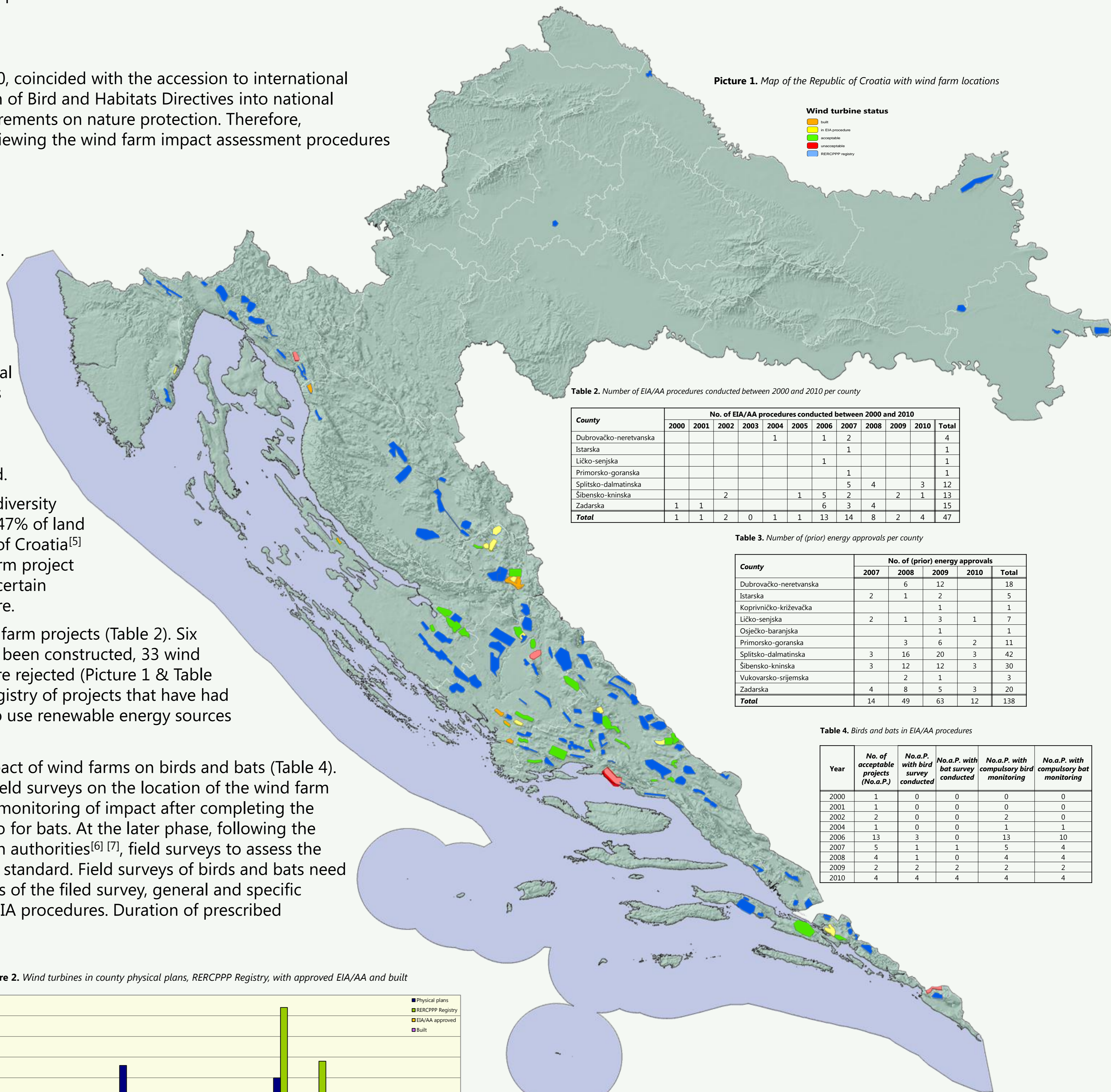


Table 2. Number of EIA/AA procedures conducted between 2000 and 2010 per county

County	No. of EIA/AA procedures conducted between 2000 and 2010											
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Dubrovačko-neretvanska					1		1	2				4
Istarska								1				1
Ličko-senjska							1					1
Primorsko-goranska							1					1
Splitsko-dalmatinska							5	4		3		12
Šibensko-kninska			2			1	5	2		2	1	13
Zadarska	1	1					6	3	4			15
<b>Total</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>13</b>	<b>14</b>	<b>8</b>	<b>2</b>	<b>4</b>	<b>47</b>

Table 3. Number of (prior) energy approvals per county

County	No. of (prior) energy approvals				
	2007	2008	2009	2010	Total
Dubrovačko-neretvanska		6	12		18
Istarska	2	1	2		5
Koprivničko-križevačka			1		1
Ličko-senjska	2	1	3	1	7
Osječko-baranjska			1		1
Primorsko-goranska		3	6	2	11
Splitsko-dalmatinska	3	16	20	3	42
Šibensko-kninska	3	12	12	3	30
Vukovarsko-srijemska		2	1		3
Zadarska	4	8	5	3	20
<b>Total</b>	<b>14</b>	<b>49</b>	<b>63</b>	<b>12</b>	<b>138</b>

Table 4. Birds and bats in EIA/AA procedures

Year	No. of acceptable projects (No.a.P.)	No.a.P. with bird survey conducted	No.a.P. with bat survey conducted	No.a.P. with compulsory bird monitoring	No.a.P. with compulsory bat monitoring
2000	1	0	0	0	0
2001	1	0	0	0	0
2002	2	0	0	2	0
2004	1	0	0	1	1
2006	13	3	0	13	10
2007	5	1	1	5	4
2008	4	1	0	4	4
2009	2	2	2	2	2
2010	4	4	4	4	4

## CONCLUSIONS

- Beginning of wind farm development in Croatia from 2000 coincided with the accession to international agreements in the field of nature conservation and the transposition of Bird and Habitats Directives into national legislation in the process of EU accession.
- Wind farm development in Croatia is mostly concentrated in the hinterland of the Adriatic Sea, which is in large percentage included in the national Ecological Network.
- Selection of potential locations for wind farms in physical plans has mainly been based on the wind potential of specific locations.
- There is discrepancy in a number of wind farm projects for which (prior) energy approval has been issued, number of wind farms foreseen in physical plans and number of wind farm projects for which the EIA/AA procedure has been performed (Picture 2); no SEA has ever been performed.
- Significant progress had been made from 2000 until 2010 in standards of nature protection and requirements of the EIA/AA procedures for wind farms, especially in regards to protection of birds and bats.

### REFERENCES:

- [1] Radović, J., Čivić, K., Topić, R. eds. (2006): Biodiversity of Croatia, State Institute for Nature Protection, Ministry of Culture - Republic of Croatia, Zagreb
- [2] Strategy and Action Plan for the Protection of Biological and Landscape Diversity of the Republic of Croatia, Official Gazette 143/2008
- [3] Energy Development Strategy of the Republic of Croatia, Official Gazette 130/2009
- [4] <http://oie.mingorp.hr/default.aspx?id=24>
- [5] <http://www.cro-nem.hr/>
- [6] Guidelines for Environmental Impact Assessment of Wind Farms – Birds, Ministry of Culture of the Republic of Croatia, Zagreb 2009
- [7] Guidelines for Environmental Impact Assessment of Wind Farms – Bats, Ministry of Culture of the Republic of Croatia, Zagreb 2009