

Effectiveness of conservation measures in 100 European Union Special Protection Areas

Supplementary Annex 1. Details of the 100 Special Protection Areas selected for the study.

Special Area of Conservation (SAC)/Site of Community Importance (SCI) and Ramsar Site status is given as Yes where there is overlap of boundaries in whole or part.

Member State	Formal SPA code	SPA name	Area (ha)	Description	SAC/SCI	Ramsar Site	Past LIFE projects	EU Biogeographic Regions									
								Atlantic	Continental	Alpine	Mediterranean	Marine Med.	Boreal	Macaronesian	Pannonic	Steppic	Black Sea
Croatia	HR1000002	Sava kod Hrušćice sa šljunčarom Rakitje	1,453.26	River habitat with gravel banks and nearby gravel pits important for breeding	Yes				Yes								
	HR1000004	Donja Posavina	121,053.27	Wetland along Sava river; large complexes of alluvial forests	Yes	Yes	Yes		Yes								
	HR1000016	Podunavlje i donje Podravlje	66,335.33	Wetland at confluence of Drava and Danube rivers; representative riparian and alluvial forests	Yes	Yes			Yes								
	HR1000020	National Park Plitvička jezera	29,698.36	Karstic river lakes; large complexes of beech and fir forests; karstic fields with wet and dry grasslands	Yes					Yes							
	HR1000022	Velebit	203,517.25	Large coastal mountain with complexes of beech and beach/fir forests; sparsely vegetated habitats	Yes						Yes	Yes					

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	HR1000024	Ravni kotari	65,114.76	Agricultural mosaics, grasslands, cropland	Yes						Yes						
	HR1000025	Vransko jezero i Jasen	5,912.98	Wetland, grasslands	Yes	Yes					Yes						
	HR1000031	Delta Neretve	23,814.31	Wetland, river estuary, coastal habitats	Yes	Yes					Yes	Yes					
	HR1000035	NP Kornati i PP Telašćica	28,570.43	Islands with sparsely vegetated land and cliffs (middle Adriatic)	Yes						Yes	Yes					
	HR1000038	Lastovsko otočje	19,572.29	Islands with sparsely vegetated land and cliffs (southern Adriatic)	Yes		Yes				Yes	Yes					
Finland	FI0200097	Koskeljärvi	1,821.0	Lake, forests	Yes		Yes						Yes				
	FI0309006	Sarkkilanjärvi	54.0	Shallow lake important resting and staging site for migratory birds			Yes						Yes				
	FI0415001	Siikalahti, Sammallampi, Rautalahti	682.0	Agricultural, coastal and marine, grasslands, wetlands	Yes	Yes	Yes						Yes				
	FI0700025	Värtsilän laakso (SPA)	521.9	Wetlands and croplands	Yes								Yes				
	FI1100203	Isomatala-Maasyvänlahti	1,531.0	Shallow coastal and marine	Yes	Yes							Yes				
	FI1101635	Etelä-Kuusamon metsät	15,368.0	Old growth forest	Yes		Yes						Yes				

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	FI1200901	Talaskankaan alue	4,915.0	Mires, bog woodlands and western taiga	Yes								Yes				
	FI1301712	Pomokaira	92,358.0	Aapa mires, western taiga forests	Yes								Yes				
	FI1302002	Kaldoaivin Erämaa	351,349.0	Mountain birch forests, alpine/boreal heaths and aapa and palsa mires	Yes	Yes				Yes							
	FI1400006	Björkör, Åland Islands	5,248.71	Marine. Boreal Baltic islets and small islands	Yes	Yes											
France	FR2112010	Barrois et forêt de Clairvaux	41,156	Continental. large forests and alluvial valleys					Yes								
	FR3112003	Marais Audomarois	178	Agricultural areas, estuaries, marshes, bogs, ditches		Yes		Yes									
	FR4112008	Vallée de la Meuse	13,562	Large forests and alluvial valleys					Yes								
	FR5212005	Forêt de Gâvre	4,481	Atlantic forests				Yes									
	FR5412007	Plaine de Niort Sud-Est	20,760	Agricultural areas, grasslands, marshes, scrubs			Yes	Yes									
	FR5412026	Pertuis charentais - Rochebonne	819,258	Marine habitats, estuarine and coastal habitats, mudflats and sandbanks, Lagoons				Yes									
	FR7210089	Pènes du Mouille de Jaout	4,399	Forests and rocky habitats						Yes							

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	FR8212023	Les Aravis	8,907	Forests and rocky habitats	Yes					Yes							
	FR9312007	Iles Marseillaises - Cassidaigne	39,158	Pseudo-steppes, grasslands, scrubs, forests, wetlands, marshes, coastal and marine habitats	Yes						Yes						
	FR9312013	Les Alpilles	26,948	Pseudo-steppes, grasslands, scrubs, forests, wetlands, rocky habitats, dunes			Yes				Yes						
Ireland	IE0004004	Inishkea Islands	1,329.76	Offshore seabird colony, grazed maritime grassland. Biggest IE non-breeding popn of Greenlandic Barnacle Goose (<i>Branta leucopsis</i>)	Yes			Yes									
	IE0004014	Rockabill	5,227.09	Offshore seabird colony. Biggest IE population of Roseate Tern (<i>Sterna dougallii</i>)	Yes		Yes	Yes									
	IE0004017	Mongan Bog	129.33	Raised bog. Breeding waders	Yes	Yes	Yes	Yes									
	IE0004024	Sandymount Strand/Tolka Estuary	2,193.17	Estuarine and coastal habitats. Multiple mon-breeding waterbirds	Yes	Yes		Yes									

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	IE0004042	Lough Corrib	18,623.94	Major freshwater body. Non-breeding wildfowl especially ducks	Yes	Yes		Yes									
	IE0004076	Wexford Harbour and Slob	5,979.34	Estuarine and agricultural. Diverse wintering waterbirds. Biggest IE population of Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>)	Yes	Yes		Yes									
	IE0004096	Middle Shannon Callows	5,814.85	Callows/floodplain grasslands. Non-breeding waterbirds including Greenland White-fronted Goose, breeding waders	Yes			Yes									
	IE0004151	Donegal Bay	10,455.87	Marine/coastal habitats. Non-breeding waterbirds especially seaducks and divers	Yes			Yes									
	IE0004160	Slieve Bloom Mountains	21,774.46	Blanket bog and upland habitats. Breeding raptors especially Hen Harrier (<i>Circus cyaneus</i>)	Yes	Yes		Yes									
	IE0004188	Tralee Bay Complex	3,655.61	Marine/coastal habitats. Non-breeding waterbirds	Yes	Yes	Yes	Yes									
Italy	IT2070402	Alto Garda Bresciano	21,526	Forests, grasslands and rocky habitats						Yes							

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	IT2080501	Risaie della Lomellina	30,941	Rivers, wetlands, marshes, and estuaries, forests, heathlands and grasslands					Yes								
	IT3321002	Alpi Giulie	18,033	Forests, grasslands and rocky habitats						Yes							
	IT4060002	Valli di Comacchio	16,781	Rivers, wetlands, marshes, and estuaries, forests, heathlands and grasslands	Yes	Yes	Yes			Yes							
	IT5180011	Pascoli montani e cespuglieti del Pratomagno	6,753	Rivers, wetlands, marshes, and estuaries, forests, heathlands and grasslands			Yes			Yes							
	IT5320017	Gola della Rossa e di Frasassi	2,640	Rivers, wetlands, marshes, and estuaries, forests, heathlands and grasslands			Yes			Yes							
	IT9110038	Paludi presso il Golfo di Manfredonia	14,437	Forests and maquis, steppe, grasslands, cliffs and rocky habitats, wetlands, coastal and marine habitats, islands	Yes	Yes	Yes				Yes						
	ITA020050	Parco delle Madonie	40,860	Forests and maquis, steppe, grasslands, cliffs and rocky habitats, wetlands, coastal and marine habitats, islands			Yes				Yes						

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	ITA040013	Arcipelago delle Pelagie - area marina e terrestre	388,044	Forests and maquis, steppe, grasslands, cliffs and rocky habitats, wetlands, coastal/marine habitats, islands			Yes				Yes						
	ITB022212	Supramonte di Oliena, Orgosolo e Urzulei - Su Sercone	23,474	Forests and maquis, steppe, grasslands, cliffs and rocky habitats, wetlands, coastal and marine habitats, islands							Yes						
Latvia	LV0200200	Kemeru Nacionalais Parks	36,184.71	Complex of coastal dunes, grasslands and wooded dune systems with raised bogs and lakes. Diverse breeding bird community	Yes	Yes	Yes						Yes				
	LV0302800	Engures ezers	12,579.52	Complex coastal ecosystem with lake and adjacent reedbeds, grasslands peatlands and dune. Diverse breeding and migrant bird community	Yes	Yes	Yes						Yes				
	LV0302900	Dvietes paliene	4,989.23	Floodplain with rivers and lakes, grasslands and woodland. Diverse migratory birds	Yes		Yes						Yes				
	LV0304200	Kuja	10,788.11	Agricultural land adjacent to Kuja River with	Yes		Yes						Yes				

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				wooded meadows, alluvial forests and mixed broad-leaved forests													
	LV0509100	Randu plavas	290.47	Coastal dune systems, with woodland and diverse heathlands and grasslands. Migratory waterbirds and breeding birds	Yes		Yes						Yes				
	LV0527400	Garkalnes meži	1,788.26	Forest with grassland, heathland and peatland habitat mosaic	Yes								Yes				
	LV0536600	Lubana mitrajs	51,344.43	Mosaic of wetlands including lake, raised bog and grasslands with diverse breeding migratory birds	Yes	Yes	Yes						Yes				
	LV0600700	Ziemeļgauja	21,749.4	Riverine floodplain with mosaic of grassland, raised bogs, heathland and diverse woodland habitats	Yes		Yes						Yes				
	LV0600800	Adazi	10,149.68	Mosaic of coastal dunes with heathland, raised bog and forest	Yes		Yes						Yes				
	LV0900100	Nida - Perkone	36,703.0	Coastal marine habitats with diverse migratory waterbirds	Yes	Yes	Yes						Yes				
Poland	PLB060004	Dolina Tyśmienicy	7,364	Wetlands / grasslands	Yes					Yes							

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	PLB120005	Dolina Dolnej Skawy	6,846	Fishponds / river	Yes		Yes			Yes							
	PLB200006	Ostoja Biebrzańska	148,509	Wetlands / grasslands	Yes	Yes	Yes			Yes							
	PLB220003	Pobrzeże Słowińskie	21,819	Wetlands / coastal	Yes	Yes	Yes			Yes							
	PLB220005	Zatoka Pucka	62,430	Coastal	Yes					Yes							
	PLB240002	Beskid Żywiecki	34,989	Forests	Yes			Yes									
	PLB320016	Lasy Puszczy nad Drawą	190,279	Forests / wetlands	Yes		Yes			Yes							
	PLB990003	Zatoka Pomorska	309,081	Marine	Yes					Yes							
	PLC080001	Ujście Warty	33,297	Wetlands	Yes	Yes	Yes			Yes							
	PLB180001	Pogórze Przemyskie	65,366	Forests	Yes		Yes			Yes							
Romania	ROSPA0031	Delta Dunării și Complexul Razim - Sinoie	508,302	Second largest delta in Europe, one of the largest wetlands in the world. Many breeding and non-breeding waterbirds and migratory species	Yes	Yes	Yes									Yes	Yes
	ROSPA0069	Lunca Muresului Inferior	17,397	Agricultural, forests. Birds of prey	Yes	Yes	Yes								Yes		
	ROSPA0071	Lunca Siretului Inferior	37,480	Lake and wetlands. Important for waterbirds	Yes											Yes	
	ROSPA0076	Marea Neagră	149,144	Costal and marine. Migratory birds	Yes												Yes

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	ROSPA0084	Munții Retezat	38,316	Forests, grasslands, rocky habitats. Important site for mountain birds	Yes					Yes							
	ROSPA0087	Munții Trascăului	29,006	Forests, grasslands. Biggest breeding population of Golden Eagle (<i>Aquila chrysaetos</i>) in RO	Yes				Yes	Yes							
	ROSPA0098	Piemontul Fagaras	71,256	Agricultural, grasslands, forests. Grassland and forest birds	Yes		Yes		Yes								
	ROSPA0099	Podisul Hartibaciului	237,780	Agricultural, grasslands, forests. Biggest population of Lesser Spotted Eagle (<i>Aquila pomarine</i>) and Honey-buzzard (<i>Pernis apivorus</i>) in RO	Yes		Yes		Yes								
	ROSPA0100	Stepa Casimcea	21,955	Agricultural, grasslands, forests. Steppe and migratory birds	Yes											Yes	
	ROSPA0103	Valea Alceului	3,601	Agricultural lands and grasslands. Raptors	Yes		Yes								Yes		
Slovakia	SKCHVU005	Dolné Považie	31,195.5	Cropland and agricultural mosaics; heathland, shrubs and grassland			Yes								Yes		
	SKCHVU008	Horná Orava	58,738	Cropland and agricultural mosaics; rivers, lakes and		Yes	Yes			Yes							

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								Atlantic	Continental	Alpine	Mediterranean	Marine Med.	Boreal	Macaronesian	Pannonic	Steppic	Black Sea
				wetlands; woodland and forest. Diverse waterbirds, Ural Owl (<i>Strix uralensis</i>)													
	SKCHVU009	Košická kotlina	17,354.31	Cropland and agricultural mosaics; woodland and forest. Eastern Imperial Eagle (<i>Aquila heliaca</i>), Saker (<i>Falco cherrug</i>), Ural Owl			Yes								Yes		
	SKCHVU020	Parížske močiare	376.58	Rivers, lakes and wetlands. Only SK breeding site for Moustached Warbler (<i>Acrocephalus melanopogon</i>)		Yes	Yes								Yes		
	SKCHVU021	Poiplie	8,062.9	Cropland and agricultural mosaics; heathland, shrubs and grassland; rivers, lakes and wetlands; woodland and forest. Ural Owl		Yes	Yes								Yes		
	SKCHVU022	Polana	32,188.38	Cropland and agricultural mosaics; heathland, shrubs and grassland; rivers, lakes and wetlands; woodland and forest. Ural Owl, White-backed Woodpecker			Yes			Yes							

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				(<i>Dendrocopos leucotos</i>), Collared Flycatcher (<i>Ficedula albicollis</i>)													
	SKCHVU028	Strážovské vrchy	58,673.08	Cropland and agricultural mosaics; heathland, shrubs and grassland; rivers, lakes and wetlands; woodland and forest. Ural Owl, White-backed Woodpecker, Collared Flycatcher						Yes							
	SKCHVU052	Čergov	35,849.71	Cropland and agricultural mosaics; heathland, shrubs and grassland; rivers, lakes and wetlands; woodland and forest. Ural Owl, White-backed Woodpecker, Collared Flycatcher	Yes					Yes							
	SKCHVU053	Slovenský raj	25,243	Rivers, lakes and wetlands; woodland and forest. Ural Owl						Yes							
	SKCHVU054	Špačinsko-nížnianske polia	12,155.66	Cropland and agricultural mosaics; rivers, lakes and wetlands; woodland and forest. Saker, Ural Owl	Yes					Yes							
Spain	ES0000004	Lagunas de Villafáfila	32,532.73	Wetlands, agricultural land, steppe birds,	Yes	Yes	Yes				Yes						

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				migratory species. Mediterranean forests													
	ES0000040	Islotes del norte de Lanzarote y Famara	17,863.73	Islands, coastal and marine. Migratory birds			Yes							Yes			
	ES0000054	Somiedo	29,006.43	Atlantic forests, raptors	Yes		Yes	Yes									
	ES0000071	Llanos de Cáceres y Sierra de Fuentes	69,665.5	Agricultural land, grasslands, forest. Steppe birds			Yes				Yes						
	ES0000084	Ses Salines d'Eivissa i Formentera	16,435.1	Coastal and marine. Mediterranean scrubs. Migratory birds	Yes						Yes						
	ES0000093	Montes de Toledo	218,013.23	Agricultural, Mediterranean forests. Raptors. Steppe birds	Yes		Yes				Yes						
	ES0000107	Montes y cumbre de Tenerife	68,023.02	Macaronesian forests. Endemic birds	Yes		Yes							Yes			
	ES0000123	Larra-Aztaparreta	3,922.85	Forests, mountain grasslands	Yes					Yes							
	ES0000144	Urdaibaiko itsasadarra / Ría de Urdaibai	3,242.31	Estuaries, coastal and marine				Yes									
	ES0000470	Marjal dels Moros	626.71	Wetlands, rivers and lakes							Yes						

Supplementary Annex 2. Main strengths and weaknesses in setting Conservation Objectives (COs) in each assessed Member State

Country	Strengths and good practices	Weaknesses and gaps
Croatia	Establishment of COs is consistent in approach, defined by a single document COs address all target species and their habitats	COs lack quantified attributes and targets for the condition of species and their habitats, except for population size of species breeding in the site COs do not address the threats to the site No clear link of COs to ecological requirements of individual species
Finland	COs are set in specific Management Plans Participatory planning is used in drafting all Management Plans	COs are described in general level COs do not identify the condition which the species should reach in most sites COs don't reflect the importance of the sites for the species maintenance or restoration
France	COs usually target all species. Threats are well identified and in line with the COs	There is a time lag of between five and ten years between the date of designation and the approval of the DOCOB (Document d'Objectifs, equivalent to a management plan) COs remain general and not very detailed
Ireland	COs present and standardised use of waterbird monitoring data (in five second-generation documents only)	Lack of site-specific COs in half of the sites. Inconsistent list of species between classification acts, COs and Standard Data Forms in most sites Lack of any relation between COs and actual known threats
Italy	COs address threats well COs reflect the importance of the site for the species	COs are generic and broadly formulated, do not identify the species covered in most cases and do not include the condition of the species
Latvia	In some management plans there are initiatives from individual experts to establish numeric and specific COs	COs are poorly developed in most cases COs are not comprehensive, are usually very broadly defined and not quantified
Poland	COs are clearly linked with the features for which the site has been classified	Some COs are very generic and broadly defined, without precise attributes and targets COs do not reflect the importance of the sites for relevant species

Country	Strengths and good practices	Weaknesses and gaps
Romania	COs are prioritised according to the importance of the site for the species present in some sites	Most of the COs are generally described COs do not include quantitative and measurable targets
Slovakia	COs define the condition to achieve for the species and their habitats and have quantified attributes and targets	COs from SPAs are not supplemented by a broader set of conservation targets COs are valid for 30 years, which is a long period
Spain	COs cover the most relevant species in most of the SPAs analysed and reflect the importance of the site	COs in some management plans do not address relevant species and their habitats but conservation of biodiversity in general COs description is rather general in some cases

Supplementary Annex 3. Examples of procedures for the establishment of Conservation Objectives and Conservation Measures

In Croatia, the Nature Protection Act states that conservation objectives and conservation measures for target features of Natura 2000 sites are to be defined in two ordinances (for SPAs and for SCIs) enacted by the Minister responsible for nature protection. Conservation Objectives for SPAs are set in the Ordinance on conservation objectives (OG 25/2020; corrected version: 38/2020) which covers all Croatian and lists COs for all target species per site.

In France, COs and CMs are compiled in a document produced for each Natura 2000 site or for a group of sites, called DOCOB (Document d'Objectifs), which is equivalent to a management plan. The creation or revision of the DOCOB follows a specific official procedure as defined by the environmental code (L414-1 to L414-3).

In Finland, COs are first set in the SDF (in general level). CMs are provided in site-specific management plans. The state agency Metsähallitus has elaborated guidelines on the management of protected areas (*Principles of Protected Area Management*) which are regularly updated.

In Ireland, there are some site-specific generic documents setting COs, but there is only an outdated conservation plan for one of the sites considered in this study. The documents setting COs can be divided in first, second and third generation of significantly different quality.

In Italy, COs and CMs are usually defined in the management plans of the sites and are defined by the regions and the autonomous provinces based on the indications provided by the Ministry of Ecological Transition in the *Guidelines for the preparation of management plans for Natura 2000 sites* and in the *Minimum uniform criteria for the definition of conservation measures for SACs and SPAs*.

In Latvia, COs and CMs are provided in site management plans. Site management plans have a mandatory standard format, set by the special Cabinet Regulations No 686, and must include chapters on COs and CMs, apart from many other information.

In Poland, COs for Natura 2000 site are usually set in the site management plan. Two formats of management plans are used: (1) the so called "plan of conservation measures", established for ten years by regional conservation authority, is the most common, and (2) the so called "conservation plan", established for 20 years by the Ministry. For marine sites, only the format of "conservation plan" is allowed. There is no broader strategy of setting conservation objective nor broader objectives established on regional or national level.

In Romania, all management plans follow the methodology established in 2017 by the Ministry of Environment and published in the *Guide for preparing and evaluating management plans for protected natural areas*. Management plans were adopted for each of the SPAs of Romania through a Ministerial Order.

In Slovakia, all management plans follow the methodology defined in a national Decree, which includes some criteria and indicators for assessing the species conservation status adapted to the site level.

In Spain, the Biodiversity Law (2007) requires national and regional authorities to establish the necessary CMs in all SPAs and SACs, which is usually done with management plans officially adopted. The Spanish Ministry of Environment published Guidelines for Natura 2000 conservation in Spain in 2011 (and currently being updated), with the aim to guide the elaboration of management plans for Natura 2000 sites. SEO-BirdLife also published guidelines for the elaboration of management plans for SPAs.

Supplementary Annex 4. Summary of methodological issues faced by the assessment and future recommendations

SPA selection

The selection of the sample of 100 SPAs was not random but directed to achieve a selection of sites most likely to include those with management processes and structures to assess (as the primary objective of the study). This was through the positive selection of sites that were also SAC/SCI and/or Ramsar Sites in the case of wetlands, as well as those with past LIFE funded projects. In terms of outcomes however, this likely skews the results to be more positive than a truly random sample.

There is thus a tension between the possible objectives of a study which seeks to explore 'stories' – as this study did – or seeks through randomised sampling to gain a statistical understanding of the *status quo*. This is resolvable only in terms of the high-level objectives of any study.

Assessment process

Ideally data gathering would have been undertaken using face-to-face interviews and/or site visits. The sample of correspondents (Table 1) whilst adequate, was not large. The not unexpected finding of different perspectives indicates that as large and diverse sample of correspondents is desirable for the soundest assessment of the status quo.

It would have been helpful to have had time to undertake a second round of interviews or questionnaires, following up issues arising from the first response. Time did not permit this, especially as some national authorities delayed responding, despite multiple reminders, until at, or beyond deadlines making meaningful follow-up and exploration of issues impossible.

It is likely that some respondents did not understand all questions of the survey (e.g. due to language problem or terminology used, e.g. on changes in land uses or human activities benefiting/harming the species). Some respondents had prepared their responses carefully while some in haste (quality of responses varied). Clearly responses from authorities were more comprehensive as they are in better position to understand the questions (for example, obligations arising from Conservation Objectives and Conservation Measures (CM)).

Interestingly most of the Finnish respondents neglected to mention the statutory measure as one of the most effective CM i.e. the establishment of a nature conservation area by the Nature Conservation Act. Instead, they considered mainly active measures in their responses such as habitat restoration measures.

Assessments of what percentage of qualifying species benefit from the implemented CMs should be considered very cautiously; they are very subjective figures influenced by both inconsistencies in lists of qualifying species between classification acts, Standard Data Forms and other official site documents, as well as general lack of information on CMs, as well as poor understanding of CM effectiveness due to widespread lack of monitoring.

Questionnaire design

Assistance in the design and formulation of questions from social science and/or market research professionals would have been useful. Many questions/options had a significant degree of ambiguity, including lack of definition of key terms.