

## STUDY ON THE CLASSIFIED SPECIFICATIONS OF THE LAND USE/COVER OF THE COASTAL ZONE IN CHINA

Xuezhong JIANG, Caixing YUN & Zhen HAN  
State Key Laboratory of Estuarine and Coastal Research, East China Normal University,  
Shanghai 200062, China E-mail: jiangxzh@vip.sina.com

**Abstract:** Compared with the former classification system of the actual land use and the classifying system of the town land, the up to date land classification system, starting to try out on January 1, 2002 by the Ministry of Land and Resources P. R. C., improved a lot on protecting plantation area and regulating the management standards. It is adapted to the requirement of the law and the market economy system, and it is also propitious to keeping consistent with the international rules. But it is a system mainly for land environment, without content applicable for coastal zone, and no considering that the characteristic of the coastal zone is distinguished different from the land environment. Based on analysis of the characteristic of the coastal zone and the different application objectives, the paper attempts to constitute the classified specifications of the land use/ land cover of the up tidal zone, intertidal zone and shallow water region in China to consummate the land classify system in existence. Our goal is that the new specifications will be applicable not only for the remote sensing applications, coastal land use / land cover mapping, but also for the integration management of the coastal zone and provide the foundation for the sustainable development applications.

**Key words:** Land use/cover, Coastal zone, Classify specifications

Land use and land cover are the definitions to describe or express the nature, form and character of the earth surface. Generally, land use emphasizes on the social economy attributes and the land cover emphasizes particularly on the natural attributes of the soil. Changing of the relationship between human being and the nature lead to the land use and land cover change (LUCC) , which is one of the main causations to arise a series of global environmental problems(IGBP et al., 2001; SHI Peijun et al., 2002). And the coastal zone as the alternation area affected by the ocean effect and land process has the environment vulnerability with high population density ( LIU Yanhua et al., 2001). The changing acted by the human beings on the ocean and coast has obviously overrun the natural process in many areas (SHI Peijun et al., 2002; Liana Talane-Mcmamus, 2001), the very rapid LUCC makes crucial effect on the global change. Study on the coastal land use/cover as one of the main issues and idiographic goals of the LOCIZ (Holligan P M and DeBoois H., 1993; WU Zhifeng et al., 1999) has gained comprehensive attentions.

China has a large population compared with low land resource. The exploitation of coastal resources is during rapidly developing stage. The coastal area, by way of primary support land resources (LU Guo-qing and GAO Fei, 1996; LIAO Jin-feng, 2000), regarded as a new economic increasing point at many local areas. Rapid exploiting with relatively uncultured coastal management leads to disorder of the most exploitation and the deterioration of the coastal ecological environment (PENG Jian and WANG Yang-lin, 2000; ZHANG Qiao-min et al., 2001).

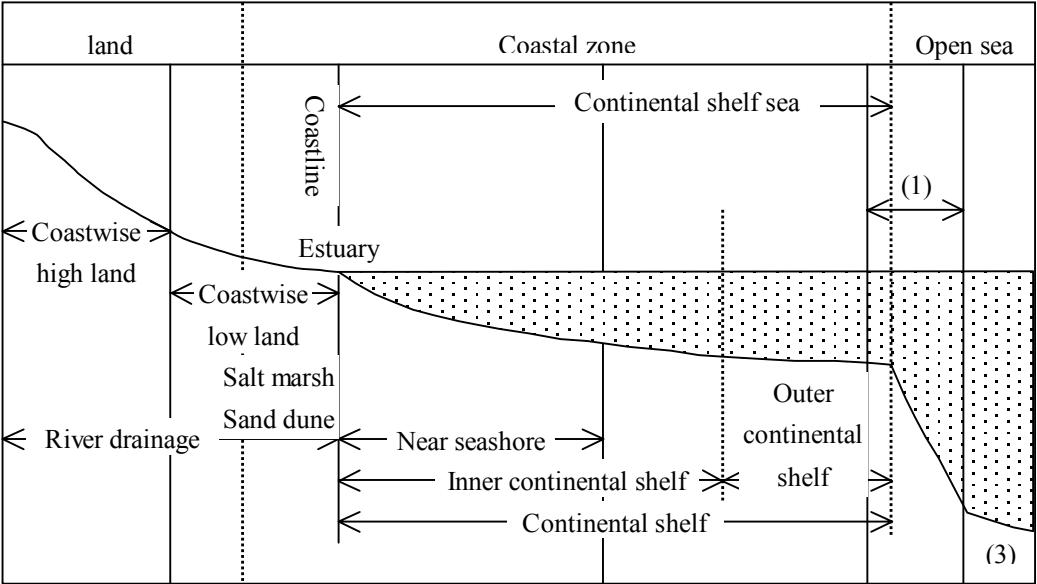
Land use/cover classification system is in a state of confusion although it is the foundation of land use, evaluation, exploitation and management, and there is still no classification

system conformable to land classification of coastal zone (WANG Ren-chao, 2002). The latest land classification system by the Ministry of Land and Resources P.R.C. can't completely meet this demand either (XU Zhong-guo et al., 2002). Because of the difference in measures, goals and classification standards in dynamic observations of coastal land, it is difficult for us to share information and redundant resources and contrast between districts (WANG Shao-qiang et al., 2001; YANG Gui-shan, 2001). On basis of analyzing the characteristic of coastal zone, the paper will discuss the establishment of classification system of the coastal land use/cover to supply and perfect the present land classification system and imply in the new coastal remote sensing survey of coastal resources and environment.

**1. DIVISION AND CHARACTERISTIC OF COASTAL ZONE**

Coastal zone is a place where land, air and ocean interact with each other. In this zone there is high physical energy, diversity of life-form and plenty of exploitation activity by human beings, but environment is vulnerable in the global changes.

In view of the definition of coastal ecological system, it concludes the estuary, bay, lagoon, strait, delta, fresh water forest swamp, seashore salina, beach, tidal zone, islands or islets, coral reef, seashore dune and all kinds of inshore /offshore water area. Its superior landward limitation is the area where salt water and half salt water can extend. The narrow sense of sea area is inshore shallow water region while the broad sense can spread the whole continental shelf (YUN Caixing et al., 2002). The narrow sense of coastal zone includes uptidal zone( the inshore land above the average high tide line), intertidal zone and underwater coastal sea slope. By now four standards are used in distinguishing coastal zone: natural standard, administrative borderline, appointed distance and selected environmental unit. In the survey of coastal zone and shoal since 1981, outward limitation is defined as the isobath ranged from -10—-15m; inward limitation extends 10km or so into the land. There's no universal standard in the division of coastal zone so every country has its own standards in defining the supervisory bound (YUN Caixing et al., 2002). In the systematic study of earth IGBP coastal definition model is adopted to define coastal zone to fully reflect its peculiar situation and give prominence to the interaction between ocean and land (CHEN Xuelej, 2000).



(1) Continent marginal sea (2) Continental slope (3) Ocean bed  
**Fig. 1** Conception Model of coastal zone of IGBP (1993,1995)

In the study three classification systems are established according to up tidal zone, intertidal zone and subtidal zone. Up tidal zone refers to the area above the high tide height of spring tide, basically belonging to terraneous environment. Intertidal zone refers to the land occasionally protruding between high tide height and low tide height varies along with tidal cycle and the tide height. Inshore sea area refers to the region below the low tide height and extend to the isobath ranged from -10—-15m.

## **2. CHARACTERISTIC AND INSUFFICIENCY OF THE NEW LAND CLASSIFICATION SYSTEM AND OCEAN FUNCTIONAL CLASSIFICATION**

Compared with the former classification system of land use and town land, the unified classification system of city and country tried on since Jan 1, 2002 is more scientific and systematic. It is adapted to the requirement of law and market economy system. It is also propitious to keep consistent with the international rules, protect plantation land and standardize the land management order (XU Zhongguo et al., 2002).

But the new land classification system mainly aims at land environment, too cursory in classify coastal zone and doesn't look on the sea area as country resources. For example, beach land listed in (3) class in other kind of unused land (32), but the nature of beach land varies with districts. The present classification system can't fully embody the natural characteristic of the coastal zone. With the rapid development of coastal zone and diversity of exploitation model, present classification system can't fit the peculiar type of coastal zone and sea area, such as float storage, purse net breed aquatics areas, artificial islands and so on. It is improper because it doesn't include the sea area especially the inshore sea area as country resource and doesn't focus much on the exploitation, utility, management and domination of sea resource (CHEN Xuelei, 2000).

Functional classification of ocean environment is a kind of divisional and graded administration mode which aims at protecting the ecological environment. The exploitation and utility of coastal zone can't contravene the functional characteristics of the region. Land use/cover classification system of coastal zone included and extended the demands of dividing and grading the sea area.

## **3. CLASSIFICATION CRITERION**

### **3.1 CLASSIFICATION CRITERION**

Land use/cover classification system of coastal zone must embody the mutual relationship between human beings and the nature, that is to say we must attach importance to both the natural changes and the social economic activity (Turner R K, et al., 1998) and management/share of spatial information. On account of these, some criterion and principles should be followed.

Firstly, scientific principle. The classification system should reflect the natural and social characteristic of the coastal land.

Secondly, open and dynamic principle. The classification system can carry out data interchange with outside according to the dynamic development of land use. Meanwhile, with the development and in-depth study of the social and economic environment of land use, we should adjust and modify the classification standards. Land use is regional so classification system needs to be compatible and leave some spare space for future development (XU Zhongguo et al., 2002).

Thirdly, unified principle. On one hand, the classification system has a united criterion to ascertain the first grade, the second grade, the third grade and so on. On the other hand, the classification system must conform to the land classification. The coastal zone is a place

where sea and land interact with each other, while establishing the classification system we must consider to consistent with the land system.

Last but not least, the classification system must be in accordance with the laws, statutes and actual application. It must accommodate with the land management law, some other laws and statutes. It also should cater the requirements of market economy on the legal attributes of land, sea area and clan land.

### **3.2 CLASSIFY METHODS**

The classification system of coastal zone must base on different landforms and utilized pattern. We adopt multigrade classification in defining grade of regional unit to fulfill the demands when we distinguish remote sensing information of various spatial measures and decide mapping scale. We consider the spatial configuration diversity of the classified result and the rationality of types combination so that the result can reflect the spatial distributing rule of land. Three special systems are adoptive as up tidal zone, intertidal zone and shallow water region.

### **4. CLASSIFY AND CODING OF THE COASTAL LAND USE/COVER**

According to the classification systems of the ministry of land and resources P.R.C., national land office and ministry of construction P.R.China, and refer to the classification standards of American coastal land use/cover systems, we attempt to set up three individual classification system referring to up tidal zone (Table 1), inter-tidal zone (Table 2) and shallow water region (Table 3) to consummate the land classify system in existence. Our goal is that the new specifications will be applicable not only for the remote sensing applications, coastal land use / land cover mapping, but also for the integration management of the coastal zone and provide the foundation for the sustainable development applications.

The code of the intertidal zone follows after the code of up-tidal zone, the code of Class I (farming intertidal zone) is number 4, Class II and Class III then is 4\*, 4\*\*, construction intertidal area is 5, 6 for unexploited intertidal area; code for shallow water region begin with 7, and continuing afterwards. Totally, there are 3 types for class I of the intertidal zone, 10 types for class II and 34 types for class III; and 3, 11 and 36 for shallow water region.

### **5. DISCUSSIONS AND CONCLUSIONS**

Scientific land use/cover classification system is a symbol of land scientific level, it also assure the sustainable use of land. Because of the dual attributes of coastal zone and complexity caused by regional difference, one classification system can't solve all problems. The up tidal zone, intertidal zone and shallow water region vary in characteristics. The up tidal zone is influenced mostly by land environment; especially the developed region has more social attributes. The intertidal zone where land interacts with sea most actively is influenced basically by the periodic tide, has both natural and social attributes, while the shallow water region has more natural attributes. So we attempt to adopt three classification system to classify the land use/cover more clear.

Up to now, the study and development of coastal zone in China is at a high speed. But the low level of domination, management and the chaos state of classification system lead to disorder in exploitation and deterioration of coastal environment. The classification system of land use/cover in this paper means to serve the resource survey, the remote sensing mapping of coastal zone, the utility of coastal resource and the sustainable development of society. As a result of the long coastal line, regional difference and different study objectives, we don't give out the fourth and fifth grade criterion. So far as we adopt the united classification criterion and standards and comprehensively consider the utility mode, natural attributes and resource characteristics, we can classify more practically in real situation.

**Table 1** Classification system of up tidal zone

| Class I (code)                  | Class II (code)                           | Class III (code)  |
|---------------------------------|---|---|
| farming land<br>(1)             | plantation<br>(11)                        | irrigative field(111), natural field(112), man irrigating field(113), dry land(114), kailyard(115)  |
|                                 | garden plot<br>(12)                       | garden plot(121), mulberry garden(122), teagarden(123), latex garden(124), other garden(125)  |
|                                 | woodland<br>(13)                          | woodland(131), shrubbery(132), scatter woodland(134), ruins(135), nursery(136)  |
|                                 | grassland<br>(14)                         | natural grassplot(141), reformative grassplot(142), manual grassplot(143)   |
|                                 | farming water<br>(15)                     | pond(151), breed aquatics surface(152), field irrigation works(153)   |
|                                 | other farming land<br>(16)                | beast breeding yard(161), establishment farming land(162), country path(163), field ribbing(164), bleachery(165)                                |
| construction land<br>(2)        | commercial and serving trade land<br>(21) | commercial land(211), finance and insurance land(212), restaurant and hotel(213), other severing trade land(214)                                |
|                                 | industrial storage land<br>(22)           | industrial plot (221) , mining plot (222) , storage area (223)  |
|                                 | public service land<br>(23)               | public foundation service area (231) , sight plot (232)   |
|                                 | public buildings<br>(24)                  | department and republic building (241) , education building (242) , scientific research building (43) , hospital (244) , charity building (246) |
|                                 | dwelling house<br>(25)                    | town single dwelling house (251) , town mixed dwelling house(252), country house(253), unoccupied plot(254)                                     |
|                                 | communication land<br>(26)                | railroad(261), highway(262), civil air port(263), port and quayage(264), pipeline transportation(265), street and alley(266)                    |
|                                 | water conservancy land<br>(27)            | reservoir(271), water engineering building(272)   |
|                                 | special land<br>(28)                      | military land(281), embassy land(282), religionary land(283), prison land(284), graveyard(285)  |
| other construction land<br>(29) |   |   |
| other land (3)                  | other land (31)                           | wild land(311), saline-alkaline land(312), dene(313), bare land(314), bare rocky and gravelly land(315)   |
|                                 | other waters<br>(32)                      | river waters(321), lakes(322), glacier and permanence snow(323), other unutilized waters(324)   |

**Table 2** Classification system of intertidal zone

| Class I (code)                  | Class II (code)                        | Class III (code)  |
|---------------------------------|--|---|
| farming intertidal area (4)     | culture area (41)                      | beach culture area (411) , enclosure culture area (412) , purse net fishery (413) , other fishery plot (414)          |
|                                 | woodland (42)                          | mangrove(421), manual woods(422)  |
| construction intertidal area(5) | industrial storage area (51)           | mining place(511), salt pan(512), energy industrial place(513), near shore platform(514), other mining place(515)     |
|                                 | public area (52)                       | scientific research area(521), other public area(522)   |
|                                 | commercial and serving trade land (53) | tour serving land(531), other commercial and serving trade land (532)   |
|                                 | aquatic construction land (54)         | sea dyke(541), groyne(542), along bank dyke(543), water lead walls(544), culvert (545), gate(546)                     |
|                                 | Communication area (55)                | bridge(551), dike(552), pipeline(553), electric power and communication cable(554), navigation assisting symbol (555) |
|                                 | special land (56)                      | military area(561), sewage and dust plot(562)   |
| unexploited intertidal area(6)  | wetland (61)                           | swamp(611), bare beach(612)   |
|                                 | others (62)                            | flood discharge channel(621), nature protected area(622), reserved land(623)  |

**Table 3** Classification system of shallow water region

| Class I (code)            | Class II (code)                         | Class III (code)   |
|---------------------------|---|--|
| fishery sea area(7)       | cultured area (71)                      | net enclosure culture area(711), net cage culture area(712), raft culture area(713), suspend culture (714)   |
|                           | fishing sea area (72)                   | fishing stake(721)   |
| offshore construction (8) | industrial storage sea area(81)         | oil and natural gas drilling platform(811), other mining platform(812), electricity works(813), industrial water taking mouth(814), floating storages(815), aquatic product machining establishment(816) |
|                           | commonality establishment (82)          | park at sea(821), offshore island(822), scientific research area(823), manufacture supporting establishment(824)   |
|                           | commercial and ministrant sea area (83) | trade at sea (831) , other commercial and ministrant waters(832)   |
|                           | transportation sea area(84)             | port dock(841), anchoring berth(842), anchor ground(843), navigation assisting symbol(844), bridge(845)  |
|                           | especial sea area (85)                  | military waters(851), trash area(852)  |
| unused sea area (9)       | near shore islands (91)                 | islands and islets(911), submerged reef(912)   |
|                           | bottom of shallow waters (92)           | rocky seabed(921), sandy seabed(922), muddy seabed(923), biological seabed(924)  |
|                           | offshore waters (93)                    | red tide waters(931), ice area(932), polluted waters(933), sunken ship(934)  |
|                           | other waters (94)                       | protected waters(941), other waters(942)   |

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