The interface between political ecology and actor-network theories: exploring the reality of waste

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Abstract

Human-environment relationship is a prominent discourse in many academic disciplines. Initial studies in social sciences viewed nature being independent of society but gradually researchers proved that both are related and dependent upon each other. Current studies confirm the association between humans and the environment which changes with time and space. Waste is part of the human environment and is ubiquitous. Climate change, environmental pollution, and vulnerabilities associated with it have been major concerns for policymakers, activists, and academicians across the globe over the past couple of decades. The report of International Solid Waste Association (ISWA) and United Nations Environment Program (UNEP) in 2006 delineated waste management as an important part of urban infrastructure having close relation to issues of urban lifestyle, resource consumption pattern, income level, jobs, socio-economic and cultural factors. According to World Bank estimation in 2018, waste generation will increase from 2.01 billion tones in 2016 to 3.40 billion tones in 2050. However, despite its significance in the academic world, the waste remains under-theorized. The meaning and value of waste vary from person to person and also from culture to culture. Rapid urbanization and globalization have led to the social, economic and political crisis with an increased amount of waste. The multidimensional nature of waste creates the need for interpreting it in a distinct way. With the help of theoretical pluralism, this paper aims at explaining the concept of waste through the theoretical lens of political ecology and actor-network theory. The political ecology perspective aims at explaining the environmental issues by analyzing the political-economical causes and provides the alternative for solving the issue. The actor-network theory explains the environmental issues by studying the association among actors at various scales with a special focus on the power interest of the actors as the cause of such association. These two approaches can be integrated based on the pragmatic approach and can help in understanding the complex reality of waste. The paper views that societal problems like waste can be studied with the use of both these theories with a firm hold on the context as they tend to transcend the dualism between nature and society.

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Abstract
Human-environment relationship is a prominent discourse in many academic disciplines. Initial studies in social sciences viewed nature being independent of society but gradually researchers proved that both are related and dependent upon each other. Current studies confirm the association between humans and the environment which changes with time and space. Waste is part of the human environment and is ubiquitous. Climate change, environmental pollution, and vulnerabilities associated with it have been major concerns for policymakers, activists, and academicians across the globe over the past couple of decades. The report of International Solid Waste Association (ISWA) and United Nations Environment Program (UNEP) in 2006 delineated waste management as an important part of urban infrastructure having close relation to issues of urban lifestyle, resource consumption pattern, income level, jobs, socio-economic and cultural factors. According to World Bank estimation in 2018, waste generation will increase from 2.01 billion tones in 2016 to 3.40 billion tones in 2050. However, despite its significance in the academic world, the waste remains under-theorized. The meaning and value of waste vary from person to person and also from culture to culture. Rapid urbanization and globalization have led to the social, economic and political crisis with an increased amount of waste. The multidimensional nature of waste creates the need for interpreting it in a distinct way. With the help of theoretical pluralism, this paper aims at explaining the concept of waste through the theoretical lens of political ecology and actor-network theory. The political ecology perspective aims at explaining the environmental issues by analyzing the political-economical causes and provides the alternative for solving the issue. The actor-network theory explains the environmental issues by studying the association among actors at various scales with a special focus on the power interest of the actors as the cause of such association. These two approaches can be integrated based on the pragmatic approach and can help in understanding the complex reality of waste. The paper views that societal problems like waste can be studied with the use of both these theories with a firm hold on the context as they tend to transcend the dualism between nature and society.

**Keywords:** Climate change, Waste, Urbanization, Globalization. Political Ecology, Actor-Network theory

**Introduction**

In human society, waste is inherent with all kinds of social institutions, social processes, and social actions. Waste has always been there in society from the beginning of human civilization. It is ubiquitous. The only difference is in the type and volume of the waste which has varied over the period. Waste has created social, economic and political crises with ongoing urbanization and globalization. When we look at waste, they are more than litter. These ownerless wastes have made our landscape a 'trashscape' (Thill 2015). Waste has a strong relation with time because everything can become waste with passing time. Whatever we desire today may not be desired tomorrow. In that sense, desire and discard are the two important elements of waste. Waste itself can be referred to as the desire which is no more desire (Thill 2015). Till now, all the perspectives on waste are descriptive that have focused on the waste producers and the institutions managing waste. In such cases, culture, societies, and linkage among them have been overlooked. While studying waste, many of its dimensions are missed out by the researchers. Thus the multidimensional nature of waste needs to be studied and the different disciplines have a lot to contribute to a better understanding of waste. Waste entails a powerful call for engagement in a transdisciplinary study. Waste particularly attracted the attention of academicians, when Susan Strasser in her book “waste and want” in 1999 initiated the debate over “waste”, the ignored phenomena. She described the social history of the trash and how it influenced the life of people in western countries. She described the historical evolution and development of different types of waste and their meaning. Again Martin O’Brien (2008) tried to paint the picture of the rubbish society with a detailed analysis of rubbish histories in the context of European societies. All these studies were based in the developed countries. The developing countries were not there in the picture. Martin O’Brien talked about waste in a broader sense by using the term ‘rubbish’. The multidimensional nature of waste like ‘rubbish literature’, ‘rubbish industries’, ‘rubbish households’, ‘rubbish relationships’, ‘rubbish idealism’, and ‘rubbish materialism’ were discussed extensively in his book. For him, waste is never a waste but entails a value. It is an unavoidable and important constituent of social life. It has the power of technological, economic and social transformation (O’Brien 2008). In his words, “It is time to get a proper intellectual and political grip on the rubbish reality that drives social change” (O’Brien 2008). For example,
trash industry flourished in South East Asia and helped many people economically. The entrepreneurial role of waste is economically enriching. This brings the opportunity to study the reality and social dynamics of waste in the society.

Putting it in another way, the study of waste is similar to that of the study of man and environment relationships. From the very beginning, the issue of man versus nature has led to the debate over including the physical environment in sociological analysis, developing discourses and theoretical frameworks. The sociological study of nature has come a long way. The initial studies of nature were deterministic analysis but now it has reached to a post-modern analysis, which now explains environmental problems as being socially constructed (Jovicich 2015). Later the works of Ulrich Beck, Niklas Luhmann, Anthony Giddens, George Ritzer, Zygmunt Bauman, Manuel Castells, Bruno Latour, and John Urry included environment and related risks in their studies and developed useful concepts which ultimately enriched environmental sociology (Lidskog et al. 2014)

**Idea of theorization**

‘Environmental Sociology is strong and well established enough that it can tolerate and even thrive within, theoretical pluralism. The diversification of the field is opening up avenues of theoretical innovation and synthesis that were not present a decade ago. Furthermore, this more diversified theoretical base is increasing the opportunities for environmental-sociological theory to be integrated more closely into concrete empirical research.’(Buttel 2001)

The environmental problems created by waste are known to everyone. Waste generates green house gases and environmental pollutions like soil and water pollution. The environmental issues should not be merely viewed as the change in nature that needs to be solved but in terms of society/nature dynamics. The problem of waste is not simply a problem for the scientific community which needs to be solved scientifically. This is a problem possessing both social and environmental processes. It is the fact that the dualities of people and their environments are deeply intertwined (Neumann 2004). Hence the social scientists should analyze the issue of waste as a result of dynamic interaction between nature and people rather than simply stressing on the features of the waste issues alone. The reality of waste is very complex and putting in the words of Bhaskar (1975), the visible things are only real externally and the research process includes ‘peeling the layers of the onion’ that itself can be related to the difference between what is visible in day to day life and scientific research through empirical measurements and this gives the picture of the ‘real’ structures. Solving all the issues of waste in a particular setting is not an easy task because there is no single reality. The multiple realities of the waste need to be researched extensively.

As theories help us to understand the world better, the theoretical formulations will certainly help us to solve the issue of waste. Robbins (2012) noted that the impact of the physical environment on social action remains a relatively under-theorized research area. Sometimes, the issue of waste is said to be socially constructed but the social problem of waste does exist. Similarly, the environmental issues are simply explained as a social construction and the problems are viewed as if they themselves do not exist. If it is so, the ozone layer would go away, the moment people stop discoursing about the issue (Radder 1992). There may be disbelief about the impact of climate change, risks of waste on human society, but these do have their impacts on humans even after their refusal (Murphy 1997). The social construction of environmental issues depends on successful ‘claim-making’ by social actors like scientists, industrialists, politicians, journalists, civil servants, and environmental activists. Such social construction of environmental issues became prevalent during the early 1970s (Hannigan 2006). Here their political and economic interests were hidden. To uncover such issues, political ecology and Actor-network theory can be of great help. According to political ecology, none of the environmental problems occur in isolation of political and economic force and there is an unequal distribution of the costs of the environmental problems (Brant and Bailey 1997). Those who exploit nature and those who don’t are unevenly affected. Beyond the visible problems, exists the power structure, institutional arrangements, administrative pitfalls, linkages and many more that will be exposed with careful application of the political ecology and actor-network theory.
While analyzing the existing power dynamics, political ecology needs to broaden its explanation by adding biophysical dimensions in the study of the system and network. The details of the power dynamics like ‘power alongside’, ‘power beneath’ and ‘power in spite’ need to be included in the analysis of the social networks. Along with all these, the type of connection such as positive or negative, terms of connection, the strength of the connection, the structure of the network, position of the actor in the network needs to be explained. The belief behind such analysis lies in the socio-ecological network between structure and agency due to the continuous interaction between human and the non-human entities (Rocheleau and Roth 2007). As stated by Rocheleau and Roth in 2007 ‘The world is always networked’. These networked relationships will shed the light on the required actions at the policy level.

As the urban areas are mostly engulfed with the dilemma of handling and disposing waste in a sustainable manner, the urban spaces have the opportunities to be studied in a different context and space. As viewed by the urban political ecologist, the continuous interaction between humans and nature increases with the growth of the cities (Hartman 2012). The increasing volume and risks associated with waste in urban areas are linked with population growth and the development of cities. Waste management is very complex with the environmental, social and economic issues involved. All these issues need to be considered while researching the life cycle of the waste, water, soil, and air defilement as a result of various littering practices and dumping. The increased volume of waste and its mismanagement has repercussions at the local (in terms of air, water, and soil pollution, the spread of diseases) and the global (in terms of global warming, climate change and so on so forth). In this context, both the local and global impacts need to be taken care of by improving the environment and controlling the climate change (Ferronato and Torretta 2019).

The policies in the urban areas need to be carefully formulated for the genuine and efficient management of waste because a sustainable society depends on a coherent and competent waste management system. While doing a political-ecological analysis of waste and implementing environmental policies, the role played by the natural forces and complex ecosystem dynamics must be considered (Nygren and Rikoon 2008). The increased volume of waste and its mismanagement has repercussions at the local (in terms of air, water, and soil pollution, the spread of diseases) and the global (in terms of global warming, climate change and so on so forth). In this context, both the local and global impacts need to be taken care of by improving the environment and controlling the climate change (Ferronato and Torretta 2019). The policies in the urban areas need to be carefully formulated for the genuine and efficient management of waste because a sustainable society depends on a coherent and competent waste management system. While doing a political-ecological analysis of waste and implementing environmental policies, the role played by the natural forces and complex ecosystem dynamics must be considered (Nygren and Rikoon 2008).

With the help of literary sources, the paper makes an effort to answer a few questions on the understanding of the waste issues. Such as ‘What is the theoretical framework to study waste in detail’? In the context of global environmental sociology, how can waste be studied? Can there be a holistic picture of waste with the use of theoretical pluralism? What is the need for theoretical pluralism in the waste study? How political ecology and actor-network theory are integrated into the waste study? Why is the linkage between two established?

The need of theoretical integration

Globalization has restructured modernity. The impact of such restructuring has resulted in the emergence of new kinds of issues in every arena of life. In the same manner, it has affected the relationship between society and the environment. This ultimately demands the environmental sociology of Globalization (Lidskog et al. 2015). Due to rapid globalization, social and political factors play an active role in shaping environmental issues. Here comes the need to take help from political ecology. In urban political ecology, where the environmental issues can be explained by focusing more on the political structures and in ANT, where the movement of networks between the actors can be analyzed to reveal the power dynamics can provide a holistic picture of the issue. In the case of political ecology, these political structures affect the uneven distribution of resources that in turn result in inaccessibility to environmental facilities and impoverishment of people. Such a case has been highlighted by Pelling in his study of urban flood in 2003. He also argued unwillingness on the part of the politicians to help people and non adoption of different strategies to improve the situation further made the situation worse. This again resulted in economic and social inequality and
deterioration of the environment. Heynen et al. in 2006 outlined the importance of including social and political issues related to environmental problems while studying it. When the problems are analyzed with political and social issues involved, it empowers the researchers to provide better alternatives to solve the real world problems.

In the actor-network theory, the network and the power structure can be revealed by studying who is related to whom. Power relation within and between the communities, state agencies, and markets influences access to a clean environment. Because waste is a complex object, a single ontological and epistemological orientation will never solve the purpose. Thus there is a need for using multiple ontology, which can be referred to as a plural ontology. As there will be plural ontology, plural epistemology and plural methodology will be applied to study and understand waste properly. Here there has been an attempt to integrate both idealist and realist ontology. Pragmatic philosophical orientation, where there is acceptance of multiple standpoints and the focus is more on practicality is appropriate in the context of waste. In the state of affairs of waste, some may view it as indispensable to society and some may view it as a social problem. The interpretation and understanding do not end here, the complex system of waste needs to be expressed. In this case, there is a need for theories that can give us a comprehensive picture of waste. In Environmental sociology, the study of waste and its settings can aid in grasping its deep-rooted causes.

**Previous theories and studies**

Environmental issues can be studied sociologically with the help of many theories. There are theories by classical sociologists that got refined and molded to study environmental issues. During the period of the 1960s and 1970s when the western world started to look at the environmental issues from a researcher’s point of view, there was a deep inclination towards classical sociology. Environmental sociology has the ontology of ecology- materialism and a deep connection with the classical thought. That is why the new theories are based on the scaffolding of classical theories (Buttel 1996). Marx’s materialistic interpretation, Durkheim’s ‘social fact’ and ‘division of labor’ explained population density, resource scarcity, and the upcoming environmental problems in future. Weber’s ‘historical-comparative methods’, ‘rationalization’ and other concepts were further expanded and used to understand environmental issues by different researchers. Despite all these, the classical theories had its limitations as they could not explain the modern world problems. Buttel criticized the classical theories for their “Eurocentricity”. He further added that the classical theories considered the nation-state as a self-evident unit of analysis. The theories were never unaware of the process of globalization. In the 20th century, systems theory again had an impact on the study of the environment through Parsonian theory and later Luhman’s theory. After this, critical theorists and world system theorists tried to give environmental sociology a different angle but were not that predominant. A major revolution occurred when Catton and Dunlap developed NEP (New Environmental Paradigm) to systematically study the man-environment relationship. Then a significant shift happened with the development of theories of modernity. Gidden’s work on ‘modernity’ and ‘reflexive modernization’, Beck’s work on ‘risk society’ caught the attention of academicians (Buttel et al. 2001). There has been a continuous shift in paradigms in the study of the environment in Sociology that tried to study the environment.

**Studies on waste**:

The study of waste has been not so popular in sociology. Melosi’s ‘Garbage in the City’ (1983), Strasser’s ‘Waste and Want’ (1999), Miller’s ‘Fat of the Land’ (2000) demonstrated how waste is related to economic, political and social arenas of life. Initial studies were conducted by popular anthropologist Mary Douglas who wrote ‘Purity and Danger’ in 1966. She talked about dirt and viewed that there is nothing called dirt as the dirt lies in the eyes of the beholder (Douglas 2002). Her work has inspired many researchers to study this such as McLaughlin in 1971, Thompson in 1979, Loon in 2002, Scanlan in 2005 and Inglish in 2002. They wonderfully depicted the waste scenario but their work was culture-specific. It lacks the analytical framework and theories to understand waste in the contemporary period. After that, there have been works on various dimensions of trash like law and waste, waste management problems of cities, trash trade and many more.
Why political ecology and actor network theory?

Environmental Sociology as the sub-discipline of sociology also has a relationship with many disciplines concerning the environment as the research areas. It has its relationship with geography, political science, anthropology, psychology, science and technology studies, biology, environmental studies, etc. This interdisciplinary relationship contributes a lot to environmental sociology (Lidskog et al. 2014). Along with relationships with various disciplines, there are debates and discussions about various theories and methodologies. Such kind of debates and engagements lead to new ideas and concepts that further enrich Environmental sociology. In some cases, environmental sociology accepts the ideas from other disciplines and subjects but before their usage, they are critically analyzed (Lidskog et al. 2014). Similarly, the waste issue can be understood in a better manner by engaging with multiple disciplines.

In the present era of globalization, global environmental sociology is the need of the hour. In a globalized world, everything is related to, affected by each other. Global environmental sociology views every environmental issue in its context specificity. Thus there is always a close link between local and global. This particularly is studied by both political ecology and actor-network theory. This will help in understanding the local issues such as the environmental protests in local areas with a deep understanding of its connection to the global level. Both global and local are intertwined here and not considered as separate entities. The issues may be global environmental governance or global environmental movements. So global will be analyzed in terms of local and local in terms of global. This theory explains all the issues by connecting the local with the global. It adds a cosmopolitan perspective to general sociology as well (Beck 2009). Castells' in 2009 noted the need for the place and flow-based sociological analyses in a globalized world. The better understanding of the emergence of context and the impact of contextual approach in local and global approaches can help in getting new findings, concepts, theories and may help other sub-disciplines as well.

In the actor-network theory, everything is considered starting from subject to object and humans to non-humans. There is no distinction between nature-society, subject-object, and human- non-human. The relationship among all these is discovered by ANT. In the words of Latour, 2005 ‘There exists no relation whatsoever between ‘the material’ and ‘the social world’ because it is this very division which is a complete artifact’. The relationship and the cause of such a relationship is the central issue here. It explains the cause of the way things happen in society. Social unity is not the reason for such a relationship and network but the reason is material benefit or power. When humans come in a relationship with objects, they create a power structure which may be visible or invisible. This power relationship is exposed and understood by employing ANT. If both political ecology and actor-network theory will be used in studying the problem of waste, it will provide a full picture, not a partial one. To dig the reality of waste deeply, these are the two instruments.

Political ecology

Bertrand Jouvenel coined the term ‘ecologie politique’ in 1957 in French, whereas Eric R. Wolf coined it in English. The field developed in the discipline of geography and has a link with cultural ecology as well. Political ecology is critical in nature and views every phenomenon in a dialectical way. This dialectical tradition has been borrowed from Marx and Hegel. It not only criticizes but also provides alternatives. Other than being largely eco-centric, it studies the ecological and human conflict by understanding human actions and interests (Brant and Bailey 1997). In Land Degradation and Society, Blaikie and Brookfield (1987) define political ecology as an approach that ‘combines the concerns of ecology with a broadly defined political economy.’ Though it emerged in Geography, it has a strong tie with anthropology and sociology.

As noted by Robbin (2012), the unique characteristics of political ecology include

- to enlist the winners and losers in environmental issue
- to narrate using human–non-human dialectics
- to start from, or end in, a contradiction

Political ecology provides critical human-environment analysis. Kropotkin was the first researcher in political
ecology who talked about the inherent relationship between man and nature. He proved the impact of man on nature. He further argued that the type of social inequality is not at all natural but manmade. His work was followed by the works of Humboldt, Reclus, Wallace, and Sommerville. With the use of political history, they could demonstrate the existing underdevelopment and inequality (Robbins 2012). There is a Marxian orientation in political ecology and the explanation of all environmental issues is mostly based on uncovering the power structure (Forsyth 2008). The environmental issues are depicted as a result of political processes.

The cost and benefit are inherent in environmental issues. Political ecology analyzes these but puts more importance on the political aspect of the issues which is the only cause of all other social problems associated with environmental problems (Bryant and Bailey 1997). In political ecology, as the nonhuman objects are intertwined with humans, they are also assumed to be political. These nonhuman objects are transformed into political objects by human interaction. Things tend to become something else when they come in contact with people. They do change their behavior and effect. Such a very complex relationship can be discovered through a dialectic analysis, by determining the winning and the losing party, by a chain of explanations. The historicity of ecological processes takes a pivotal role in such analysis (Robbins 2012). In other words, every kind of environmental issues and injustice associated have a historical cause. It is not a result of human interference only but has a historical process involved in it.

There is indeed theoretical fluidity in the political ecology framework (Khan 2013). It is used to study every kind of environmental problem in every area such as rural, urban and semi-urban. For instance, to study the environmental problems in urban areas, urban political ecology can be used. Political ecologists with the use of case studies, participant observation, survey and ethnographic methods aim at finding out the political economy affecting the local activities and the environment through the social network. Along with these, sometimes, researchers use time series analysis, remote sensing, archival research, network analysis of various actors and are analyzed both quantitatively and qualitatively (Robbins 2012). Political ecology has the power to analyze waste with its relationship to the actors and institutions with all these tools, techniques and methods.

As urbanization is growing rapidly and the global urban population is going to outreach the rural population, the climate change issues and environmental problems are more urban in nature. In political ecology, the phenomenon of urbanization is viewed as a process of transforming nature. If we talk about political ecology in urban areas, there is the concept of situated urban political ecology which is concerned more about theorizing the everyday practices of the urban actors. They are of the view that a better understanding of the environment emerges from the critique of everyday life (Loftus 2012). Here they talk about urban metabolism that is happening among humans and non-humans at various scales. The urban areas are viewed as the transformed nature. As it is impossible to separate humans from the natural world, nothing can be understood without understanding the socio-natural relationship. The consciousness about such a relationship emerges through everyday interaction with nature (Loftus, 2012). Multiple events are occurring simultaneously in the urban environment and urban dwellers. The continuous influx of material and energy inside the urban system is producing more environmental problems in terms of green house gas emission, air pollution, waste creation, water pollution and many more. In urban political ecology, these problems are the result of the hybridization process. In this process, every physical, biological, social, cultural, economic and political factors are involved. For example, the problem of the high volume of waste is a hybrid one, where multiple factors and processes are involved, making the issue more complex. It thus posits that we, as researchers, should only determine in advance the empirical phenomenon that we are interested in studying while letting the various actors, objects and practices that constitute that phenomenon dictate where our research might lead us. This is premised on the view of the urbanization of nature as a dialectic process, which necessitates engaged urban research. These insights can be further developed through a focus on the everyday practices and experiences of actors that constitute cities and their more-than-urban geographies (Connolly 2018). Every day practices and experiences can be better studied by social scientists with a qualitative approach. After modernity changed the lives of humans and the environment, postmodernism emerged with a new view. The postmodernism idea of urban political ecology is that there is no need for a single narrative but multiple narratives about what people experience and how they differ from each other.
This simply goes beyond the dichotomies between global-local/ rural-urban.

**Actor network theory**

For ANT world is a network (Law 1992). In this network, humans, objects, ideas, concepts are networked. These are viewed as actors and the theory searches for the network among all these actors (Latour 2005). Thus not only humans but also nonhumans and objects are included in the analysis. The kind of network they create results in some sorts of power and inequality in society (Law 1992). According to Latour (1996), society can only be explained in the form of the network, not through system, structure, categories or layers. The network refers to the movement of things or actors. Latour has focused on the movement of actors and the way movement is recorded in network theory. The society and nature distinction is superseded in network theory. Every actor in the network, their characteristics, distribution of properties, connections, circulation of such connections are subject to the theory. The theory studies the relational aspects of the phenomena. Here the reality becomes a reality, only when there is the interaction among actors and the interplay among them goes on (Cordella and Saikh 2006).

The relational dimension of the waste can be studied with it. Thus in waste issues, there can be a deep study on the properties of the relationship between waste and people and how this relationship becomes very dynamic and evolving. It is not simply the effect of waste on people or the effect of humans on waste but more than that. The theory argues that nonhuman objects do have an impact on humans and they have the power to transform the society or the existing social structure. The actor-network theory has become very influential in studying the interaction between humans and inanimate objects. It will be useful in studying how waste influences the social life of humans. It can help in analyzing the orientation of the actor-network theory. It holds the power to view the issue of waste critically and uncovering the association between different stakeholders like state, private bodies, and other organizations involved.

According to Murdoch (1997), ANT gives a single unified theoretical lens and establishes an association between the social and physical by taking them together which is heterogeneous. Hence ‘Actors are networks rather than human beings and these networks are relentlessly heterogeneous’ (Murdoch 1997). Objects too have powers when they are associated with the actors and social processes. ANT takes up the responsibility to find out the association among the actors and through such explanations, it tends to elucidate the way the society or social structure works (Elder-Vass 2008). ANT views all the humans, non-humans and artifacts creating interconnections which are very often non-local and scale breaking. Such explanations across the scales and the objects, humans, and non-humans give a multiple and heterogeneous perspective through ‘association’ and ‘mediations’, hence unfolding the nature-society dialect. The dialectic relationship between two which is debated and discussed among academicians and the researchers is brought under a single framework of networks by actor-network theory. The theory digs deeper into the relationship and stresses the interconnection between the objects and humans that is established consciously or unconsciously. This kind of engagement of ANT helps the researchers to work on and to understand anything and everything despite its scale, time and place (Allen 2011).

The continuous social interaction and the connections are based on plants, animals, humans and the material artifacts taken together. Sociologically speaking, social refers to social fact (Durkheim 1895). Here in ANT, the analysis moves beyond the dualism of social/natural, subject/object, individual/group, agency/structure, micro/macro, local/global, inside/outside, particular/universal (Latour 1999). It sees everything, humans and nonhumans alike and the related studies. Thus ‘social’ is something that is not associated with humans only but something that is assembled or networked.

The concept of human versus nature is flawed because we are part of nature. There is only one way in which a distinction can be made between humans and nature- that is humans can change their environment the way they want, whereas other species cannot (Vinci 2014). Humans are capable of changing nature. This is purely anthropocentric but the only difference in the way in which it can be used. It looks more into the matter of the way actors are connected, disconnected and reconnected in the society. This theory has more potential to offer how and why the interconnections are established and such associations are transformed.
continuously over some time (Latour 2005). Actor-network theory emerged within the field of science and technology studies (STS) in the 1980s. The major works in this field of ANT were Callon and Latour (1981), Callon (1986), Law (1986), and Latour (1988). The works of Latour (1988, 1993, 1999), Barry (2001), Mol (2003), and Law (2004), articles by Callon (1986, 1998), Callon and Latour (1992), Czarniawska (2004, 2009), Latour (1987, 1988, 1992, 1999, 2002, 2004, 2007, 2008), Law (1992, 19997, 1999, 2002, 2004, 2007, 2008), Law and Singleton (2005), Mol and De Laet (2000), and Mol and (1994, 2004) are some of the best works in ANT.

### An overview of the theories and their concerns

| ARENAS | POLITICAL ECOLOGY |
|-----------------|------------------|
| DISCIPLINARY FOUNDATION | Geography |
| EMERGENCE | The 1970s |
| NOTABLE SCHOLARS | Piers Blaikie, Tom Bassett, Harold Brookfield |
| VIEW ON HUMAN-NATURE RELATIONSHIP | Human and Nature are different conceptually |
| FORCES OF SOCIAL ECOLOGICAL CHANGE | Environmental problems are associated with the political interest |
| UNIT OF ANALYSIS | Those who are benefited and those who lost in the due course of the environmental problems |
| STRENGTH | Power and political analysis in a dialectical way |
| WEAKNESS | Limited focus on a bio-physical aspect of environmental issues and more focus on local |

(Source: Jovicich, 2015)

### The linkage between political ecology and actor network theory

Both theories provide an integrative explanation of the local and global.

Both aim at finding out the causes of the issue rather than the basic characteristics of the issue.

In political ecology, there has been an analysis of the ‘assemblages’ of both humans and nonhumans which makes the world. It accepts the fact that both man and nature have a close relationship and they both affect each other (Murdoch 1997). Similarly in ANT, both the human and nonhuman entities are taken together to study the network between them.

- Waste though seems politically neutral or apolitical, can be explained in a political-ecological way, where both political ecology and actor-network theory has the role to play.
- Political ecology and actor-network theory propose the existence of multiple actors, stakeholders, and processes in every kind of complex problems.
- To understand every issue, researchers need a chain of explanations not a single explanation.
- Scholars have identified the linkage and similarities between the two theories. Indeed, Holifield in 2009 posited actor-network theory as an alternative to political ecology.
- They go beyond the binaries of nature and human and study it as a whole

### Implication on Sociology of Waste

If we talk about the buzz word among all environmentalists, that is ‘Sustainable development’, it seems to be political-economical. Sustainable development has never really happened; rather nature has got capitalized over the period. The irony is that despite this, sustainable development has never got critically analyzed (Escobar 1996). In the light of Sustainable development goals, waste issues have to get an important place in the list of policy formulators and developmentalists.

In this case, ANT has much to offer to the sociology of waste both on a conceptual and on a practical level. It provides a hybrid perspective taking the ecological aspect of the waste issues, which in turn broadens the conceptualization and analysis of waste problems. The actors and power dynamics in the hybrid analysis are very helpful. Though the theory has been used rarely to study the interaction between nature and humans, it is sufficient to study the dynamics of the interaction between waste and people (Cordella and Saikh 2006). Thus ANT proposes theoretical and methodological tools to study these relationships.
These have a lot to contribute to ‘waste’ literature. The increasing volume and complexity of waste need a more sophisticated view of relationships between humans and objects. As the reality is fluid and it has multiple natures, it helps in having a theoretically informed sampling and data collection which helps to understand the ways waste as object shape social relationships. Hird and Lougheed et al. in 2014 mentioned that objects become an issue and involve in politics when it comes to the relationship with humans. Both theories help to unravel the structural and social processes associated with the production of waste. It helps in understanding the social exclusion in all forms of certain classes who associate themselves with waste and who live on waste. Various studies have been undertaken to identify the problems the waste pickers face. These certainly uncover the reason for the prevailing inequality associated with waste. The illegal dumping sites and the very act of dumping are again economic and political. Mostly the villages or the nearby city areas become vulnerable to such dangerous and hazardous dumping sites. The growing waste business in the cities and their network can be identified with the help of the study in urban political ecology. The issues of recycling, incineration and environmental injustice are the important areas to look at. Over the years, waste has proved as a source of conflict in society, hence it can be useful in understanding politics in everyday life concerning waste.

Robbins (2012) has acknowledged the contribution of the actor-network theory in answering research questions that arose due to development and led to environmental issues. The reason is the multiscaleality of the issues. Power, players at multiple scales and the historical account of the current socio-economic condition are examined in political ecology. Hence the use of two frameworks is helpful to the researchers studying waste. Researchers have the autonomy to combine different kinds of approaches without following one particular approach. Even if methodology cannot solve the epistemological problems, it can surely help in understanding social processes and the way things happen in a particular setting (Cresswell et al. 2010). To sum up, it is important to investigate the ‘how’ and ‘why’ of the phenomena and here methodological pluralism comes to rescue.

Conclusion

To study the nature and culture divide, often there is the need to integrate all the disciplines of social science and reduce their epistemological and institutional gap. To understand this nature and culture dichotomy, a continuous interaction must exist between them to study the human-environment relationship. Such kind of interaction requires paradigmatic changes in scientific practice at the epistemological, methodological and institutional levels (Little 2007). As propounded by Barnes in 1982, to get the full-fledged picture of reality, we need to have “epistemological symmetry” and then only we can understand the cause of a particular phenomenon that is emerging from both the natural and the social worlds. Thus all the disciplines need each other’s help to expand their analysis. For example, while researching air pollution, the human element or anthropogenic forces in the analysis can be incorporated. To do so, the social science researcher can add the main biophysical forces like the geological features of an area, the biological evolution of the flora and fauna and the air quality index along with the human factors, such as the transportation and communication system, household activities, industrial air emission discharged in the environment. Besides looking at both the causes, the researcher also needs to identify the ‘socio-environmental realities emerging from the interactions between the biophysical and the social worlds (Bloor 1982). With a transdisciplinary approach, the waste issue can be solved.

Political ecology already has a multidisciplinary approach as it has included the concepts, methods, and disciplines like anthropology, human ecology, geography, medicine, political economy, botany, and history. Both the theories of political ecology and actor-network theory highlight the ongoing conflicts on waste problems, the involved socio-environmental actors, revealing oft-ignored connections and relations of power. This, in turn, can be appropriated by the social science researchers and help them question of existing public policies and propose a new form of action and public policies to bring the change in waste management. Such an opportunity to work together must be seized by all the disciplines, where they can act together and tackle the real world problems like waste. This engagement requires both the scientific institutions and societal actors to acknowledge and promote such transdisciplinary research approaches. The problem
lies in the lack of communication, political will, scientific and governance structures. If such transformative and collaborative research endeavors are not fostered, then the sustainability problems cannot be resolved (Brandt and Ernst et al. 2013). The scientific and governance structure need to be such that it can adapt to the rapid socio-ecological changes.

The theories of political ecology and the actor-network theory seem to corroborate and extend each other on the aspects of analyzing the power structure in waste issues, in exploring the changing relationship between waste and people in the globalized world. They tend to transcend the dualism between subject and object or nature and society.

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